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AMERICAN
DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING • DYEING • PRINTING • FINISHING

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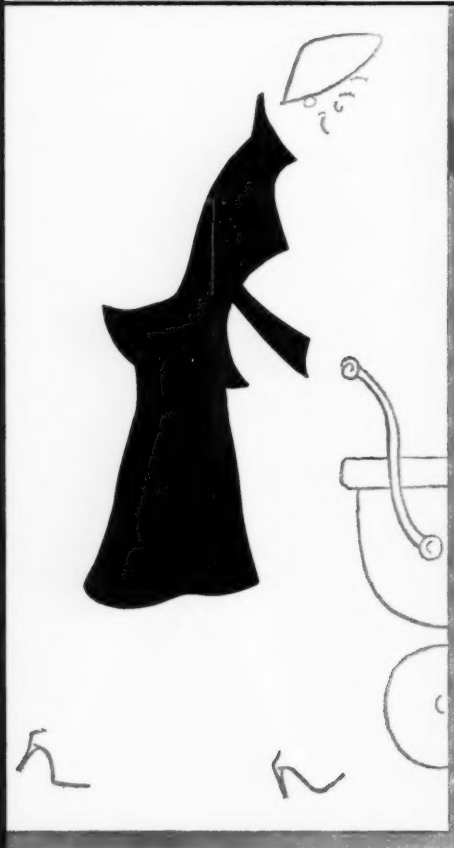
Contents of previous issues can be found by consulting the Industrial Arts Index and the Engineering Index, Inc, at your library

for "blues in the light"...
a direct dye for cotton and rayon

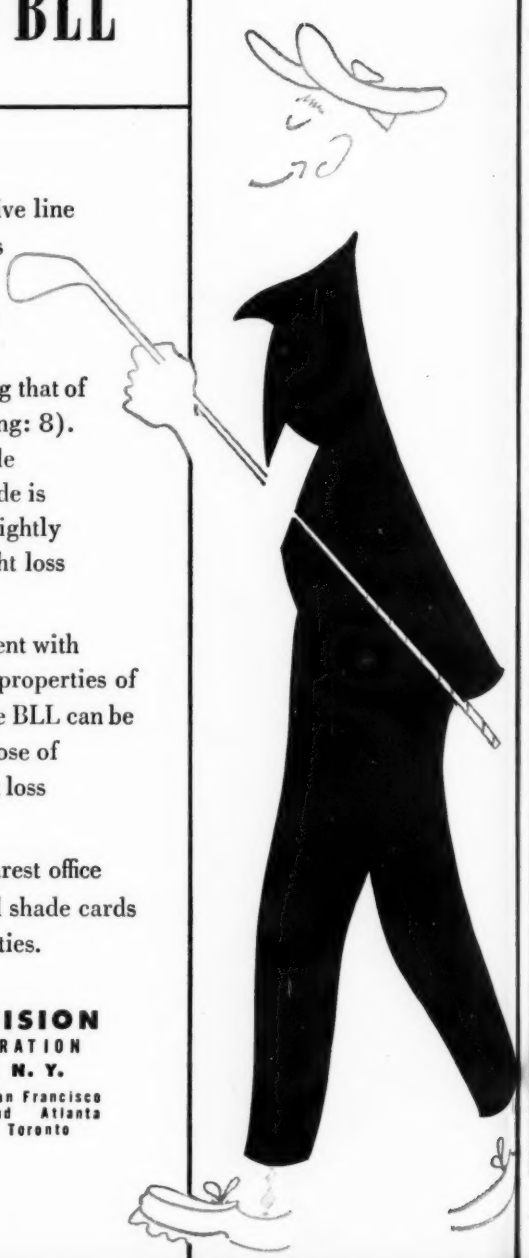
National Solantine Blue BLL



This recent addition to National's comprehensive line of direct dyes produces reddish shades of moderately bright blue with light fastness in full shades approaching that of vat dyes (AATCC Rating: 8). With urea-formaldehyde after-treatment, the shade is brightened and made slightly greener but with a slight loss in light fastness.

By simple after-treatment with Naccufix, wet fastness properties of National Solantine Blue BLL can be made comparable to those of developed dyes without loss of light fastness.

Write or phone our nearest office for samples, prices and shade cards giving complete properties.



NATIONAL ANILINE DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Boston Providence Philadelphia Chicago San Francisco
Portland, Ore. Greensboro Charlotte Richmond Atlanta
Columbus, Ga. New Orleans Chattanooga Toronto

Allied Chemical

Proceedings of the
American Association of Textile Chemists and Colorists

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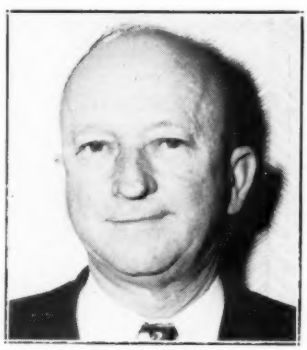
Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

JUNE 7, 1954

1954 National Convention and "The South's First Textile Wet Processing Exhibit"——

AN OPEN LETTER FROM THE RESERVATION COMMITTEE CHAIRMAN

THE Reservation Committee for the Atlanta Convention will be confronted with a few more problems than those encountered in the larger convention cities, but the main problem will be to find enough desirable space to satisfy everybody. Consequently, we must of necessity adopt certain rules and policies that will enable us to allot available space in a fair and equitable manner. We have been assured by the ten participating Atlanta hotels that fair allocations of space will enable all delegates to have comfortable quarters.



H G Smith

Hotel space, including parlors, suites and sleeping rooms, will be assigned only by the Reservation Committee and all space requests must have listed the names of those who will occupy the rooms, plus the advanced registration fees for each person listed. Forms for this purpose, for registration and reservations, will be sent you early in July. When these forms are returned they will go first to the registration committee and be cleared by them, after which the processing of reservation requests will proceed immediately.

Confirmation of accommodations will come from that hotel accepting your reservation and you will be asked to present their confirmation slip at the desk when registering.

The ten hotels to be used are all located in the downtown area of Atlanta and shuttle busses operated continuously by our transportation committee will make our headquarters easily accessible and all hotels convenient.

We are going to do our best to make you comfortable and help you have a good time. Welcome South, Brother. You all come.

Reservation Committee
H Gillespie Smith, *Chairman*

AATCC CALENDAR

COUNCIL
1954—June 15, Sept 15, Nov 19.
1955—Jan 21, Apr 15, June 17

NATIONAL CONVENTIONS
Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (New York); 1957 (Boston).

HUDSON-MOHAWK SECTION
June 18 (Outing).

MID-WEST SECTION
June 11-13 (Annual Outing—Lake Lawn Lodge, Delavan, Wis).

NEW YORK SECTION
June 18 (Outing, North Jersey Country Club, Wayne, N J).

NORTHERN NEW ENGLAND SECTION
June 11 (Outing—Merrimack Valley C C, Methuen, Mass); Oct 8 (Colonial C C, Lynnfield, Mass); Dec 10 (Woodland Golf Club, Auburndale, Mass).

PACIFIC NORTHWEST SECTION
July 24 (Outing, Mt Hood Golf Club).

PIEDMONT SECTION
June 11-12 (Outing, Mayview Manor, Blowing Rock, N C); Oct 16 (Hotel Barringer, Charlotte, N C).

PHILADELPHIA SECTION
Sept 24, Oct 29 (Penn-Sherwood Hotel, Philadelphia, Pa); Dec 3 (Kugler's Restaurant, Philadelphia).

RHODE ISLAND SECTION
June 11 (Outing—Wannamoisett C C); Oct 14 (Johnson's); Dec 2 (Annual Meeting—Sheraton Biltmore, Providence, R I).

SOUTH CENTRAL SECTION
Dec. 4 (Hotel Patten, Chattanooga.)

SOUTHEASTERN SECTION
Dec 11 (Atlanta-Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
June 18 (Outing—Chase Country Club, Waterbury, Conn); Oct 1, Nov 12, Dec 10 (Rapp's).

(A general calendar of events may be found on page 386)

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Technological Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

54-10
Education: College degree, textile chemistry & dyeing.
Experience: Chemist, dyer, finisher, superintendent.
Age: 33; married; references; northeastern U S preferred but not essential.
6-7, 6-21

54-11
Education: High School, England
Experience: Supt of finishing, synthetics; plant manager; Canada and U S
Age: 47; married; references; New England preferred but not essential.
6-7, 6-21

*AATCC Research Newsletter No. 12

NEWS IN GENERAL

On their way to the ISO conferences in Scarborough, England, William D Appel and Leonard S Little stopped off in Manchester for an informal conference June 1 with the Colour Index Committee of the Society of Dyers and Colourists. They are acting for William H Cady and Albert E Sampson, who are carrying most of the responsibility for AATCC's end of the project. Mr Cady is the American co-ordinator for this huge publishing venture and Mr Sampson is AATCC's financial representative.

Mr Cady reports that the initial printing contracts have been let to British firms, and proofs of the first two installments are already in our hands for editing. Other installments will now come along in good time. For those interested, the proofs may be seen at Howes Publishing Co, Inc, 44 East 23rd St, New York, N Y.

The 180th meeting of the Technical Committee on Research will be held at the Hotel New Yorker, June 15, 1954 at 1:30 PM. Harold W Stiegler has advised that research committees will meet on June 14 at the same address. Chairmen have been asked to file requests for meeting room accommodations.

AT RESEARCH HEADQUARTERS

Among the recent visitors to Research Headquarters were: Shigeyoshi Takano, director and mill manager of Kureha Spinning Co, Ltd, Osaka, Japan; Tenjiro Wakabayashi, managing director of Wakabayashi Spinning Co, Ltd, Osaka; and Kiyohisa Fujino, Faculty of Engineering, Kyoto University, and director of the Textile Machinery Society of Japan.

The fabrics needed for the recently organized inter-laboratory abrasion tests with the Accelerotor have been procured. The tests will get underway shortly. Considerable past work with this device on abrasion evaluations, some of it on display at the AATCC Symposium on May 19, gives much hope that the new work will produce highly significant results.

More inquiries have been received recently on the use of the Accelerotor for rapid determinations of wool shrinkage caused by felting. AATCC has some very interesting data on this use of its widely adaptable test instrument.

Several new test methods have been approved for circulation to the Technical Committee on Research for vote as Tentative Standards. They are:

Determination of Spinning Lubricant Scourability

Stoving

Bleached Woven Cloth:

Group A Series
1) Ash Content of Bleached Woven Cloth.
2) Absorbency of Bleached Woven Cloth.
3) Noncotton Content of Bleached Woven Cloth.
4) pH of Water Extracted From Bleached Woven Cloth.

Two additional methods in a Group B series (Determining the Apparent Fluidity of Dispersions of Cellulose Fibers from Bleached Cotton Cloth, and Determining the Whiteness Retention of Bleached Woven Cloth) are undergoing final revision and will shortly be submitted.

COMMITTEE ACTIVITIES

A report on "American (AATCC) Sunlight Tests" versus "Proposed International Daylight Tests" is being circulated to the Technical Committee on Research for their information.

The work of the Technical Committee on Research headed by Charles W Dorn has mounted in volume this past year to a point where it has been necessary to add a vice-chairman. Mr Dorn recently announced with understandable pleasure the appointment to this new office of the very able, long experienced AATCC committeeman, Charles A Sylvester, head of Dye Properties Div, Tech Lab, E I du Pont de Nemours & Co, Inc.

George S Wham of Good Housekeeping Institute has been appointed a member of the Committee on Washfastness.

W S Russon of Kroy, Inc has been named to the Knitted Woolens Division of the Committee on Dimensional Changes in Textile Fabrics.

G S Fisk, American Viscose Corporation, and S Nye, Warwick Chemical Co, are new members of the Committee on Chlorine Retention.

* Published every other issue of the AMERICAN DYESTUFF REPORTER.

Guide to Laws and Regulations Regarding Stream Pollution

WITH thoughts of conservation of water and the practice of prevention and treatment of water to control and prevent stream pollution ever on the increase many laws and regulations have been enacted by the federal government and the states. It has been the aim of the federal agencies assigned to this problem to try in every way possible to have the states adopt a somewhat uniform series of laws and regulations. Progress in this direction, however, has been rather slow, as each State Health Department seems to have different ideas. This is due in many cases to the location of the state, its principal industries, method of classification of streams, minimum treatment required, and the results of public hearings on the subject.

This condition presents a problem, i e, obtaining the proper information regarding these laws and regulations. Accordingly, the Philadelphia Section's Committee on Stream Pollution has submitted the following as a guide as to where such information can be obtained.

Sources

(1) "Industrial Water Pollution—Survey of Legislation and Regulations" by Marvin D Weiss, R S Aries and Associates; Chemonomics, Inc, 400 Madison Ave, New York 17, N Y; Price: approx $5.00.

(2) "Industrial Waste Treatment", *Industry and Power*, June, 1951. Write to 420 Main St, St Joseph, Mich. Reprints: 25¢ per copy.

(3) State Water Pollution Control Agency.

(4) State Health Department.

(5) The nearest Federal Drainage Basin Office.

(6) Division of Water Pollution Control, U S Public Health Service, Washington 25, D C.

(7) Any of the following Public Health Service offices:

120 Boylston Street, Boston 16, Mass; 50 Seventh Street, N E, Atlanta 5, Ga; 69 W Washington Street, Chicago, Ill; 519 Federal Building, Little Rock, Ark; 441 Federal Office Building, San Francisco, Calif; 42 Broadway, New York 4, N Y; 1014-20 Broadway, Cincinnati 2, O; 417 E 13th Street, Kansas City 6, Mo; 201 Norman Building, Dallas 2, Texas; Bldg 24, Swan Island, Portland 18, Ore.

Membership Applications

SENIOR

Frederick Brody—Chemist, Research Division, American Cyanamid Co, Bound Brook, N J. Sponsors: R S Long, S Cicio.

Wiley W Carr—Manager, Market Research, Organic Chem Div, American Cyanamid Co, Bound Brook, N J. Sponsors: E I Stearns, G Thomson.

Stanley Foster—Commercial director, The British Silk Dyeing Co, Ltd, Loch Lomond Factory, Balloch, Alexandria, Dunbartonshire, Scotland. Sponsors: W G Helmus, H Moore.

Philip E Gerold—Dyer, General Textile Mills, Carbondale, Pa. Sponsors: J S Rhodes, J Dixon.

Floyd A Hawkins—Package yarn dyer (cotton & synthetics), American Efird Mills, Mt Holly, N C. Sponsors: A P Roy, J L Rogers.

William R Joyner—Manager, Greensboro Office, Corn Products Sales Co, Greensboro, N C. Sponsors: E King, J T McGregor.

Alexander G Koos—Technical sales manager, Virginia-Carolina Chemical Corp, Richmond, Va. Sponsor: L Billings.

Richard S Lembeck—Asst stylist, textile technologist, Bachman-Uxbridge Wstd Co, New York, N Y. Sponsors: E W K Schwarz, E C Hansen.

Edmund E Martin—Boss Dyer, Globe Dye Works, Philadelphia, Pa. Sponsors: F V Traut, A E Stutzke.

James J McMahon—President, James J McMahon, Inc, New York 16, N Y. Sponsors: W A Holst, J E Loughlin.

Edward A Pendzick—Technician, Antipyros Co, Brooklyn, N Y. Sponsors: A P Speranza, M J Plescia.

Anthony W Perregrino — Dyer, Joseph Bancroft & Sons Co, Rockford, Del. Sponsors: J F Newell, J L Nauman.

William M Smith—Textile colorist & chemist, Arnold Hoffman & Co, Charlotte, N C. Sponsors: L C Connors, A H Noble, Jr.

Frank M Stevenson—Supt dyeing warps, Globe Dye Works, Philadelphia, Pa. Sponsors: F V Traut, T C Holst.

Alexander T Thorne—Dyer, Dominion Woollens & Worsteds, Ltd, Peterborough, Ontario, Canada. Sponsors: N G Koehler, J R Stewart.

Frederick J Tuohey—Dyer, Joseph Bancroft & Sons Co, Rockford, Del. Sponsors: J F Newell, J L Nauman.

ASSOCIATE

William J Goodwin — Color Development, Bakelite Co, Bound Brook, N J.

R Safioen—Head of testing laboratory, Textile Institute, Djl Raya Timur 338, Bandung, Indonesia.

STUDENT

Stanley Deckelbaum — Philadelphia Textile Institute. Sponsor: W A Hughes.

Donald M Rubin—Philadelphia Textile Institute. Sponsor: W A Hughes.

Philip G Carlson, Jr—Georgia Institute of Technology. Sponsor: W M Postman.

Charles K Cobb, Jr—Georgia Institute of Technology. Sponsor: W M Postman.

George R Norwood—Georgia Institute of Technology. Sponsor: W M Postman.

J H Hennessey

John H Hennessey Elected New York Section Chairman

JOHN H HENNESSEY, vice president of Berkshire Color & Chemical Co, Delawanna, N J, was elected chairman of the New York Section at its meeting on May 14th, 1954 at Kohler's Swiss Chalet, Rochelle Park, N J. Mr Hennessey has been active in the New York Section for many years having served as chairman of its registration committee, treasurer, chairman of the corporate membership committee, chairman of the technical program committee, and, most recently, as sectional vice chairman. He has also been active on a number of national convention committees and served as chairman of the registration committee for both the 1946 and 1951 national conventions. Mr Hennessey is a graduate of Philadelphia Textile Institute and was associated for many years with General Dyestuff Corporation until he joined Berkshire.

Other officers elected were Edmund A Leonard, Alexander Smith, Inc, *vice chairman;* John A Komninos, Waldrich Co, *treasurer;* and Norman A Johnson, AMERICAN DYESTUFF REPORTER, *secretary.*

The nominating committee was composed of Paul J Luck, Peerless Color Company, Inc, *chairman,* George L Baxter, Bradford Dyeing Association, and Henry L Young, Interchemical Corp.

The meeting, presided over by Mr Hennessey in the absence of Weldon G Helmus, chairman, was conducted as a ladies' night and featured as guest speaker Caroline Boyer, head of the education branch of the Textile Research Department, American Viscose Corp. She chose as her topic "Man-Made Fibers in Fashion" and described all of the synthetic fibers used in volume in the manufacture of apparel and other fabrics today. A number of fabrics and garments were on display. A souvenir packet, containing literature from the major producers of synthetic fibers, was distributed.

"AATCC Research——Key to Quality"——

ALL-DAY SYMPOSIUM ATTRACTS 567 REGISTRANTS

NRDGA Official Urges Formation of Joint Industry-Retail Committee

NEARLY 600 members and guests registered on May 19th at New York's Hotel Statler for an AATCC-sponsored all-day symposium, which had as its theme "AATCC Research — Key to Quality".

Highlighting the affair was a luncheon address by J Gordon Dakins, executive vice president and treasurer of the National Retail Dry Goods Association, on "Textiles' Fight for the Consumer's Dollar". Mr Dakins urged that the "fight" be one to tell the consumer and buyer how to handle textile articles in use. He suggested the formation of an industry-wide textile committee to work with retail representatives in advancing mutual interests, and expressed the hope that the work of the two groups might result in a definite policy which could serve as the basis for a joint meeting at the NRDGA convention next January.

Prior to Mr Dakins' address, AATCC president J Robert Bonnar, in his welcoming remarks, urged clarity in future standards so that they would be readily understood by the consumer.

Other luncheon speakers included ECR Chairman Leonard S Little, who served as Symposium Chairman, and Corporate Membership Chairman Albert E Johnson. Mr Johnson emphasized the role of AATCC in the formulation of new standards.

Morning Technical Session

The Morning Technical Program was handled by Jackson A Woodruff, American Viscose Corporation, *chairman,* and Edmund A Leonard, Alexander Smih Inc, *co-chairman,* and consisted of three concurrent sessions which featured the following presentations:

DYEING SESSION

Paul J Choquette, General Dyestuff Corp, *chairman*
Matthew J Babey, American Cyanamid Co, *co-chairman*
"Cellulosic Blends" — Walter Hindle, Chemstrand Corp
"Newer Blends of Wool with Synthetics" — Hans Luttringhaus, General Dyestuff Corp
"Solution Dyeing of Acetate" — A Frank Tesi, Celanese Corp of America
"Solution Dyeing of Rayon" — L Leslie Walmsley, American Viscose Corp
"Solvent Dyeing of Acetate" — Paul G Duggan, Celanese Corp of America

FINISHING SESSION

Arthur R Wachter, American Viscose Corp, *chairman*
P J Fynn, J C Penney Co, *co-chairman*
"Finishing of the Newer Synthetics" — Harry Moore, Fair Lawn Finishing Co
"Trade-Named Finishes and What They Stand For" — O M Newman, North Carolina Finishing Co
"New Finishing Machinery" — Harry F Creegan, James Hunter Machine Co

GENERAL SESSION

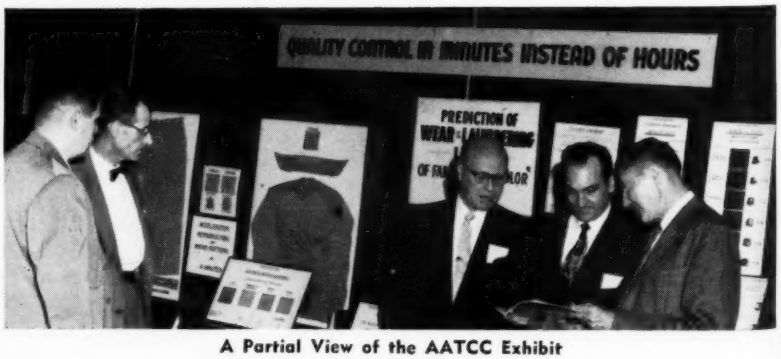
Cameron A Baker, U S Testing Co, *chairman*
Robert C Allison, Geigy Chemical Corp, *co-chairman*
"AATCC Control Tests" — Thomas G Hawley, Jr, United Merchants Laboratories, Inc
"Static in Textiles" — Kenneth H Barnard, American Cyanamid Co
"Flammability of Clothing Texiles" — George S Buck, Jr, National Cotton Council of America
"Drycleaning Techniques" — Albert E Johnson, National Institute of Drycleaning, Inc

Afternoon Panel Discussion

Charles W Dorn, J C Penney Co, served as chairman, and Charles A Sylvester, E I du Pont de Nemours & Co, Inc, as co-chairman of the afternoon panel discussion. Panel members included the following:

FIBERS — C W Bendigo, American Cyanamid Co, *chairman;* Joseph B Quig, E I du Pont de Nemours Co, Inc; Otto J Haufe, Turner Halsey Co; Gerald Lake, Burlington Mills Corp; and George H Hotte, Allied Chemical & Dye Corp.

Activity at the Registration Desk



A Partial View of the AATCC Exhibit

(L to r): Albert E Johnson, National Institute of Drycleaning, Luncheon and General Session speaker; Dr Jules Labarthe, Mellon Institute; J Gordon Dakins, National Retail Dry Goods Association, featured speaker; Richard R Frey, AATCC assistant secretary.

(L to r): Edmund A Leonard, Alexander Smith Inc, Technical Session cochairman; Leonard S Little, Symposium chairman; Carl Puller and George Schulman, Pfister Chemical Works Inc.

(L to r): P J Wood, Royce Chemical Co, Past President, AATCC; Berkeley L Hathorne, Glyco Products Co, Inc; J Robert Bonnar, General Dyestuff Corp, AATCC President and Luncheon speaker.

(L to r): Symposium committeemen Donald E Marnon, American Aniline Products, Inc; George A Jonic, American Cyanamid Co; Norman A Johnson, Howes Publishing Co, Inc.

(L to r): D D Gagliardi, consultant; George Fine, Glasco Finishing Co; Jackson A Woodruff, American Viscose Corp, Technical Session chairman.

(L to r): Raymond J Carey and George H Alpers, General Dyestuff Corp; Adolf Renold, American Cyanamid Co; Lawrence S Thompson, General Dyestuff Corp; Walter H Ridley, The Foxboro Co.

DYEING AND FINISHING — Francis S Richardson, Waldrich Co, *chairman;* Jack Leach, Burlington Mills Corp; Fred Fordemwalt, American Cyanamid Co; Charles Minoff, Texstyle Corp; and John Komninos, Glass Fibers Finishing Corp.

QUALITY AND QUALITY CONTROL — Henry F Herrmann, General Dyestuff Corp, *chairman;* Arthur R Wachter, American Viscose Corp; A C Layton Newsom, Durene Assoc of America; Rudolph C Geering, Princeton Knitting Mills; and Robert C Allison, Geigy Chemical Corp.

AATCC Exhibits

Under the direction of Richard R Frey, assistant secretary of AATCC, Harold W Stiegler, director of research, and G Robert Thompson, administrative manager, a number of exhibits showing the latest developments in test methods and instruments were on display in conjunction with the Symposium. Among the instruments on exhibit were the Accelerotor, the AATCC flammability tester, and the Launder-Ometer (using steel tubes).

Head Table Locations

The prestige of the Symposium was reflected in the distinguished names at the head table during the Luncheon Session. In addition to the aforementioned speakers, panel members, and symposium officials, the following were seated at the dais:

FIRST ROW—

Arthur B Cross, M Lowenstein & Sons Co Inc
Herbert Block, U S Testing Co
Sidney Cone, Cone Mills, Inc
Marvin Cross, Greenwood Mills, Inc
Myles Dahlen, DuPont
H J Daigneault, National Aniline Div
H Ehrhardt, Botany Mills
Louis Fairchild, Fairchild Publications
Harry Fleischer, Princeton Knitting Mills
Ephraim Freedman, R H Macy, Inc
W W Heckert, DuPont
Geo W Felker III, Avondale Mills, Inc
Walter Greer, Burlington Mills Corp
Herman Hangen, J C Penney Co
Giles Hopkins, Wool Bureau, Inc
Walter Howell, Bradford Dyeing Assoc
George F Hussey, American Standards Assoc
Waldemar R Kuenzel, Deering Milliken
Dean Lewis, Colonial Piece Dye Works

(Concluded on Page P379)

Minutes——

179th MEETING
TECHNICAL COMMITTEE ON RESEARCH

THE 179th Meeting of the Technical Committee on Research was held at the Hotel Dennis, Atlantic City, N J, on April 30, 1954, with the following in attendance:

C W Dorn, *chairman;* C A Sylvester, *vice chairman and acting secretary;* H W Stiegler, *director of research;* L S Little, *chairman, Executive Committee on Research;* R C Allison, E C Atwell, M J Babey, C A Baker, T E Bell, H C Chapin, S J Davis, H C Donaldson, Jr, E E Fickett, P J Fynn, R R Frey, A H Gaede, H E Hager, W A Holst, G H Hotte, G D Jackson, J D Mosheim, J E Norton, W M Scott, C A Seibert, C L Simon, H G Smith, R B Smith, T R Smith, R L Stutz, P Theel, L L Walmsley, H E Wilde, M Winkler, G Wiseman, P J Wood, and J A Woodruff.

Mr Dorn called the meeting to order at 1:40 pm, and announced that Mr Sylvester had been elected to fill the Committee's newly created post of vice chairman.

It was voted to accept the six-fiber cloth listed in the 1953 *Year Book* as a standard to be identified as AATCC Stain Record Cloth No. 1 or No. 1A. This will enable the American delegates to the ISO (International Standards Organization) to propose a standard test fabric for recording staining. Additional fabrics can be added as considered necessary and approved. Dr Stiegler will set up the necessary specifications for the six-fiber stain record cloth.

REPORT OF THE TCR CHAIRMAN

Mr Dorn reported on a new flammability bill that would exempt silk scarfs and change the conditions of testing from bone dry, as now specified in the AATCC method, to standard conditions (65°rh-70°F). It was emphasized that AATCC would co-operate by supplying any needed test data, but would take no position as to whether or not the test method should be changed. Dr Hager, representing the Subcommittee on Flammability, stated that eight fabrics had been distributed to five different laboratories to be checked for flammability under dry and standard conditions of testing.

REPORT OF THE ECR CHAIRMAN

Mr Little reported on arrangements for the AATCC Symposium, which was held on May 19 at the Hotel Statler in New York, and announced that the luncheon speaker would be Gordon Dakins, executive vice president and treasurer of the National Retail Dry Goods Association. Mr Little also announced that two meetings have been held between the American delegates to the ISO conferences and TCR subcommittee chairmen to determine AATCC's stand on certain proposed international test methods.

REPORT OF THE DIRECTOR OF RESEARCH

Dr Stiegler reported the following:

a) Attempts are still being made to check the seriousness of gas fading of dyed cottons;

b) A test for dynamic immersion absorption has been set up using the standard Launder-Ometer tubes and it will be submitted to the Subcommittee on Water Repellency for review;

c) In regard to dimensional changes in textile fibers, a report covering the study of eight laboratory test methods compared with commercial and domestic laundering has been circulated among the corporate membership. (This report appears on page P364 in this issue of the *American Dyestuff Reporter* under the title, "Shrinkage in Laundering of Cotton and Rayon Fabrics").

d) A new series of fulling tests employing the stainless steel Launder-Ometer tubes has been submitted for approval by TCR by letter ballot. Early returns indicate that the tests are being favorably received.

REPORTS OF SUBCOMMITTEES

Stream Pollution———Chairman Theel reported that each participating AATCC section had agreed to prepare three case histories. This committee is preparing six textile waste guides covering printing, dyeing, finishing, cotton, wool, and laundering. It is planned to have 3,000 copies of these guides available for distribution. These will be printed by the Public Health Department of the United States Government and supplied to the AATCC without charge. A bibliography of terms has been compiled by the Piedmont Section and it is planned to print 1,000 copies for sale to those interested.

High Temperature Dyeing———Prof Theel, commenting on the AATCC high-temperature dyeing project, stated that this committee had completed preparation of the samples involving wool treated with sulfuric acid and Glauber's salt, formic acid and Glauber's salt, and Glauber's salt alone, in the presence of raw water, "Permutit" water and distilled water. The tests reveal that at 250°F a rise in pH of approximately one unit takes place. Visual examination also shows discoloration of the wool at this temperature. This committee is in the process of running alkali solubility tests on all of the samples.

Publicity———Mr Jackson stated that future plans call for publicity which will cover the history, aims, work and accomplishments of the various committees with pictures of the chairmen and committee members.

Fastness to Washing ——— Chairman Fynn requested and received approval to submit by letter ballot a test developed to determine the fastness of colored textiles to alternate light exposure followed by washing. The proposed test consists of subjecting the test specimen to 20 calibrated hours of Fade-Ometer exposure followed by a No. 3A wash test. Work done at Lowell and substantiated by a comprehensive interlaboratory study has demonstrated that the results of such a test show good correlation with those followed by a No. 3A wash test. Mr Fynn reported that this committee had approved the six-fiber test cloth listed in the 1953 *Year Book* for use in evaluating staining in washing. Tests made at Lowell to determine the suitability of the Accelerotor for use in determining the color fastness of textiles to multiple washing were examined. It was decided that additional work involving a more representative range of fabrics would be necessary before a decision could be made. A new six-fiber test cloth developed by Test Fabrics, Inc, using spun yarns, is being evaluated by this committee.

Color Fastness to Light———Chairman Allison reported on the following subjects:

(a) New dyeings to replenish the supply of blue wool standards were rejected as being off shade and too fugitive to light.

(b) An investigation by this committee has revealed that, in rating color fastness to daylight and sunlight under glass, the use of the Continental blue wool standards produces ratings ½ to 2 rating points higher than those obtained when AATCC blue wool standards are used.

(c) Mr Seibert, AATCC research associate, has about finished checking the effect of various conditions of humidity and temperature on Fade-Ometer exposure. This program has required between 2,000 to 4,000 exposures. It is planned to have these recorded on a G E Spectrophotometer.

(d) A study completed last summer comparing sunlight under glass exposure in different parts of the country with Fade-Ometer exposure has indicated that one hour of calibrated Fade-Ometer exposure is approximately equal to from 1.25 to 1.8 hours of sunlight exposure depending on the locality. The study will be repeated this summer to check these results.

(e) A new master lamp is being installed at the National Bureau of Standards, Washington, D C. A new lot of blue calibration paper has been prepared to replace Lot 1554, the supply of which has been exhausted. A nominal charge will be made for this paper.

Standard Depths———Mr Babey reported that this committee was recommending that the twelve standard depths submitted by the Swiss for consideration as ISO standards be accepted with the possible addition of eight more hues. This committee is also checking the use of specified pastel shades for rating light fastness.

Bleaching———Chairman Bell reported that this committee had approved a group of five tests designed to determine the characteristics of bleached cotton at the "bleach house level." It was voted to circulate these tests for approval to TCR by letter ballot. The tests were identified as

Test 1—Method for determining the ash content of bleached woven cloth.

Test 2—Method for determining the absorbency of bleached woven cloth.

Test 3—Method for determining the non-cotton content of bleached woven cloth.

Test 4—Method for determining the pH of water extracted from bleached woven cloth.

Test 5—Methods for determining the apparent fluidity of dispersions of cellulose fibers from bleached cotton cloth.

One additional test is being considered by the committee—a method for determining the whiteness and whiteness retention of bleached woven cloth.

Standard Soils———Chairman Wiseman reported that this committee had completed a series of interlaboratory tests using one soil on eight fibers to compare two detergents. Results showed fairly good correlation between the ten cooperating laboratories. Approval was voted for a report covering the study to be submitted to Lowell and considered for publication in the *American Dyestuff Reporter*. The detergents used were tallow soap and a sodium alkylarylsulfonate. The fibers used in fabric form were acetate, Acrilan, Dacron polyester fiber, Dynel, nylon, Orlon acrylic fiber, silk, and viscose.

Durable Finishes———Chairman R B Smith reported that this committee had decided its aim should be to develop tests which would reflect consumer-use characteristics of textiles with regard to water absorbency. Plans for a series of tests have been evolved in which (a) a series of fabrics will be tested by the modified porous plate method; (b) water retention will be determined by a centrifuging method; (c) the swelling characteristics of fabrics will be determined; and (d) the textile characteristics of fabrics will be determined with regard to weight, thread count, etc. Test fabrics will include three different types of diapers—nonwoven, flannel and gauze; linen towels; muslin towels; viscose staple; viscose challis; Orlon Acrylic Fiber—81 continuous—woven; Nylonized acetate tricot; and acetate tricot.

Stoving———Chairman Holst reported that this committee had found the present AATCC standard test method 9-52 deficient on two counts: preciseness of instructions for making the test, and nonconformity of the recommended standard control dyeings used for rating with the defined characteristics. On the basis of interlaboratory work this committee has selected three top-chrome dyeings on wool which are suitable as controls and as rating standards for stoving tests on any fiber. The testing method has also been clarified. TCR approved the request of this committee that the revised test be submitted by letter ballot for acceptance as a tentative standard method.

Dimensional Changes in Textile Fabrics———Chairman Donaldson commented on the completion of the comprehensive report mentioned earlier by Dr Stiegler. The study, entitled "Shrinkage in Laundering of Cotton and Rayon Fabrics", was initiated in the fall of 1952 to determine the significance in the changes made in CCC-T-191b of increasing temperature and weight of load over that previously specified in CCC-T-191a. In view of the active participation of AATCC in ISO, British and French methods of testing shrinkage of cotton textiles were also included. Tests were run in both home rotary type laundry machines and commercial laundry equipment. (See page P364 of this issue of *American Dyestuff Reporter*).

Antistatic Finishes———Chairman Barnard reported that the results of an interlaboratory round robin of tests on the electrical resistivity of eight yarn samples, representing six different fibers, had been reviewed. Reports available from ten of the fourteen laboratories showed fair agreement when the differences in the humidity conditions of testing were taken into consideration. The committee will attempt next to standardize the electrical circuits with the same standard resistors. A statistical study of results from each laboratory also appears to be desirable. A tentative method for measuring yarn resistivity has been discussed but its adoption will await the standardization study.

Colorfastness of Dyed Cellulose Acetate to Atmospheric Oxides of Nitrogen———Mr Sylvester stated that this committee expected to have available in the near future a replenishment of the control fabric and the standard of fading.

Following the subcommittee reports, Dr Stiegler suggested the possible use of the gray scales in the proposed new fulling tests. After a general discussion it appeared to be the consensus of opinion that the gray scales should be used wherever practical.

Mr Allison, speaking from the floor, suggested that the name of the Subcommittee on Colorfastness of Dyed Cellulose Acetate to Atmospheric Oxides of Nitrogen be broadened to include all fibers. This was put to a vote and approved unanimously by those present.

The meeting adjourned at 3:05 pm.

To users of AATCC Multifiber fabric:

Testfabrics Inc, 55 Vandam St, New York 13, N Y, has announced the availability of ready-to-use AATCC Multifiber fabric in standard size pieces of 2″ x 2″ and 2″ x 4″, with the warp ends heat sealed.

Prices: 2″ x 2″ samples per m..$30.00
2″ x 4″ samples per m..$50.00
FOB New York.

Samples are put in bags of 500 pieces. Minimum: 1 m pieces.

For information on other sizes, contact Testfabrics, Inc.

SHRINKAGE IN LAUNDERING OF COTTON AND RAYON FABRICS

A Study of Eight Laboratory Test Methods Compared with Commercial and Domestic Laundering

AATCC RESEARCH COMMITTEE ON DIMENSIONAL CHANGES

The accompanying report summarizes the results obtained in an exhaustive series of interlaboratory tests which were made on 16 unshrunk and shrunk woven cotton and rayon fabrics by eight laboratory washing methods. The report also includes comparisons of the shrinkage of the same fabrics when washed in a representative type of automatic home washing machine and also a rotary washer in a commercial laundry. The results answer questions which are frequently raised with reference to differences in laboratory testing techniques and the correlation of such laboratory shrinkage methods with home and commercial practice. The report represents a substantial contribution to our knowledge of the shrinkage behavior of woven cotton fabrics. The Committee's next project should give us still more information as we plan to study the reasons for the type of shrinkage which sometimes occurs in garments made from cotton cloth which has satisfactorily passed all laboratory tests but, nevertheless, shrinks unduly when tumble-dried after laundering.

John F Warner, *Chairman*
Committee on Dimensional Changes in Textile Fabrics

INTRODUCTION

IT was felt by the AATCC Committee on Dimensional Changes in Textile Fabrics, John F Warner, Chairman, that a program should be undertaken to obtain data which should provide a good picture of the way in which shrinkage occurs in a fabric and the relation of shrinkage in domestic home laundering to shrinkage in commercial laundering.

At a meeting of this Committee on August 12, 1952, it was pointed out that a new set of Federal Specifications had been issued (CCC-T-191b). The laboratory test for shrinkage of cotton and linen included in these specifications had been revised in several respects. (The former Federal Specification CCC-T-191a Shrinkage Test is comparable to AATCC Test #14-33 and to ASTM Test D437-36).

The principal changes in the method are (1) washing at the boil for the *entire* 40 minute cycle instead of starting at a boil and allowing to *cool* during the run, and (2) increasing the load from 3 pounds to 6 or 8 pounds. It was believed that these two changes may effect the shrinkage results previously obtained, although very little difference had been observed in the few tests made by the new method. It was stated that cotton shrinkage was affected more by mechanical action than by trying to maintain the temperature at the boil.

The Committee agreed that comprehensive tests should be run to find out whether significant differences had been introduced by the changes in the new method. In addition to a study of the comparison of CCC-T-191a and CCC-T-191b, it was decided to include tests of the British and the French Shrinkage Methods for Cotton Textiles which had been proposed to the International Organization for Standards.

It was also decided that a number of cotton and rayon fabrics be washed *ten* times in a *home laundry washer* and a comparison of the results be made with those obtained during *ten commercial launderings* on the same test fabrics.

It was suggested by Ralph B Smith, Director, New Jersey Laundry and Cleaning Institute, that a series of tests be made on the test fabrics to determine the dimensional change which occurred during ten washings in a *rotary type washer*. These data could then be compared with those which had been obtained in repeated washing in the domestic washer and with the results of repeated commercial launderings.

It was believed that these additional data would further provide a picture of the shrinkage occurring during laundering and would add a comparison of a standard test method to the comparison of results obtained in end use, i e, repeated domestic or commercial laundering.

The following abstract presents only a small portion of the results obtained in this investigation. Data are given for only 2 of the 16 fabrics studied, because these 2 are typical of the entire 16. It is hoped that these will serve to illustrate the wide scope of the project and provide some slight knowledge of the magnitude of the work done by the several cooperating laboratories, as well as the volume of data analyzed statistically by the AATCC Research Laboratory staff.

CONCLUSIONS

It was the opinion of the Committee that it was not advisable to approve a new shrinkage test unless it could be shown to give substantially better results. The results of the tests conducted in the various laboratories were analyzed statistically at the AATCC Research Laboratories to determine if significantly different shrinkage results would be obtained by methods other than the former standard CCC-T-191a method.

It is believed that the former standard CCC-T-191a method using a normal 3-pound dry fabric load remains the better method since this method gives final shrinkage results closest to those obtained in commercial laundering. This method gives total shrinkage comparable to commercial laundering in all the test fabrics except the poplin fabric, even though the method is slightly less reproducible between laboratories than when a 15-pound dry load was used.

The other methods, CCC-T-191b with 3-pound dry load, the British and the French methods with 15-pound dry loads,

TABLE I. AVERAGE WARP SHRINKAGE IN PER CENT OBTAINED IN ALL LABORATORIES

Method:	*191a 3 lb*	*191a 8 lb*	*191a 15 lb*	*191b 3 lb*	*191b 8 lb*	*191b 15 lb*	*British 15 lb*	*French 15 lb*	*Commercial*	*Domestic*
Fabric, Unshrunk:										
1) Denim	12.3	12.1	11.5	12.8	12.7	10.9	11.6	11.7	12.2	11.6
2) Chambray	12.1	12.1	12.6	12.7	12.4	11.9	12.6	11.0	13.0	11.3
3) Sheeting	6.3	6.1	5.8	6.0	6.0	5.7	5.7	6.3	6.1	5.7
4) Broadcloth	3.5	3.6	3.4	3.4	3.8	3.8	3.6	3.5	3.3	3.0
6) 4-leaf Twill	6.9	6.7	6.5	7.1	7.0	6.5	6.6	6.6	6.6	6.2
7) Poplin	7.0	7.3	7.4	7.4	7.5	7.4	7.4	7.8	8.1	6.2
10) Type I, Army Twill	6.9	6.6	6.1	7.1	7.1	6.1	6.6	7.0	6.4	5.8

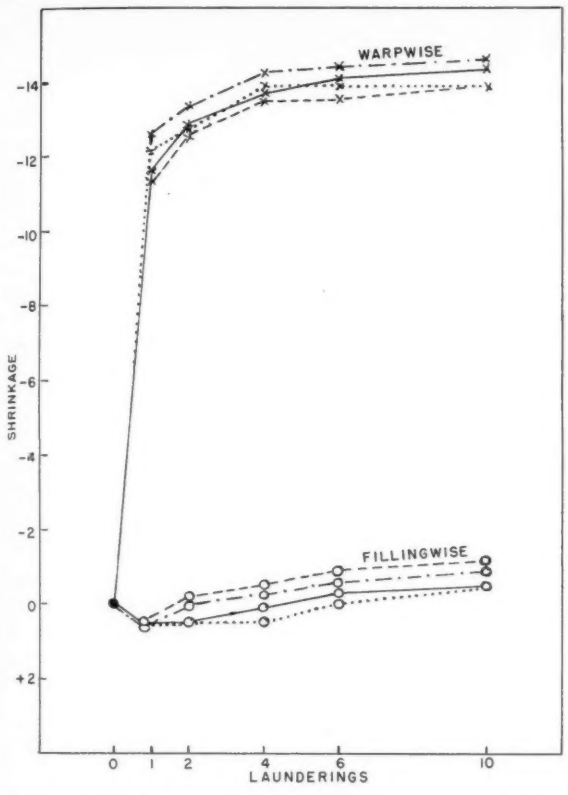


Figure 1. Shrinkage of denim, unshrunk regular mill finish, during ten launderings.

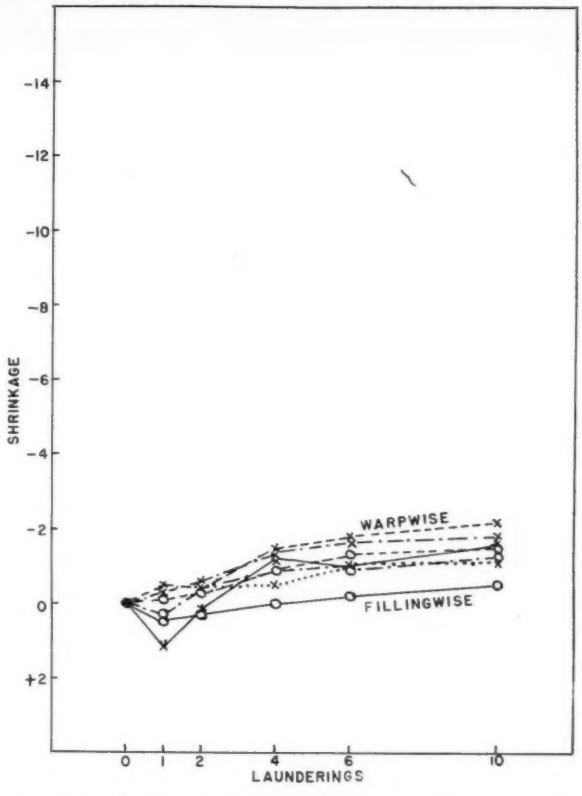


Figure 2. Shrinkage of denim, Sanforized finish, during ten launderings.

although showing no significant difference in results, give a total shrinkage which is more comparable to the lower total shrinkage obtained in domestic laundering in most instances.

Shrinkage of the domestic laundered specimens throughout ten launderings is approximately the same as obtained throughout ten commerical launderings, within a few tenths of one per cent in most instances.

No appreciable difference exists between results of repeated washings in the rotary washer and those obtained in commercial or domestic laundering, differences of only a fraction of one per cent occuring in most instances.

The effect of Sanforizing upon dimensional change is illustrated by comparing Figure 1 with Figure 2.

TEST FABRICS

The following test fabrics were obtained through the efforts of the Committee for use in this testing program. The cotton fabrics were finished both with an unshrunk regular mill finish and with a Sanforized finish. Two rayon test fabrics, one with an Avcoset finish and one with a Sanforset finish, were included. Identical sets of the sixteen fabrics were prepared and distributed to the participating laboratories.

Fabric Source and Type

1) Erwin Mills cotton denim.
2) Pepperell cotton chambray.
3) Textron Indian Head cotton sheeting.
4) Cluett, Peabody & Co cotton broadcloth.
5) ———
6) Riegel Textile cotton four leaf twill.
7) Spring Mills cotton poplin.
8) American Viscose Co lightweight challis, spun viscose, Avcoset finish.
9) Cluett, Peabody & Co, medium weight gabardine, all rayon, Sanforset finish.
10) Reeves Type I Army cotton twill.

LABORATORY TEST METHODS

Method 1: CCC-T-191a, 3-lb load

1) Prepare 3-lb dry load of fabric and place in wheel.
2) Start wheel and add water at temperature of not over 100°F. The amount of wash solution (or rinse water) should be normal for the machine and, in any event, sufficient to cover samples.
3) Raise temperature to 212°F, and then shut off heat.
4) Add sufficient soap to form running suds.
5) Run wheel 40 minutes from starting time. (Temperature drops gradually during wash).
6) Drain wheel.
7) Fill wheel to proper level with water at 140°F for first five minute rinse.
8) At the end of five minutes, (45 minutes from start of wash), wheel is drained.
9) Refill wheel to proper level with water at 140°F. At the end of ten minutes, (55 minutes from start of test), the wheel is drained.
10) Wheel rotates for five minutes, without water, to complete 60 minutes of test.
11) Samples are removed from the wheel, extracted by suitable means to approximately 55% moisture content, and then power pressed.

Method 2: CCC-T-191a, 8-lb load

(Same as Method 1 above except using an 8-lb dry load of fabric).

Method 3: CCC-T-191a, 15-lb load

(Same as Method 1 above except using a 15-lb dry load of fabric).

Method 4: CCC-T-191b, 3-lb load

1) Prepare 3-lb dry load of fabric and place in wheel.

2) Start wheel and add water at a temperature not exceeding 100°F to a level of 8", or in any event, of sufficient quantity to cover cloth completely.
3) Raise temperature quickly to 212°F ± 9°F.
4) Add sufficient soap to form good running suds.
5) Run wheel 40 minutes from starting time, *while maintaining temperature* at 212°F ± 9°F.
6) Drain wheel.
7) Refill wheel to proper level with water and raise temperature rapidly to 140°-149°F. After running 5 minutes (45 minutes from the time the wheel was started), the water should again be drained off.
8) Refill the wheel with proper level of water and raise temperature rapidly to 140°-149°F. Run additional 10 minutes (55 minutes from start of test).
9) Drain wheel.
10) Wheel rotates without water for 5 minutes (to complete 60 minutes of test).
11) Samples are removed from the wheel, extracted by suitable means to approximately 55% moisture content, and then power pressed.

Method 5: CCC-T-191b, 8 lb-load

(Same as Method 4 above except using an 8-lb dry load of fabric).

Method 6: CCC-T-191b, 15 lb-load

(Same as Method 4 above except using a 15-lb dry load of fabric).

Method 7: British Method

1) Prepare 15-lb dry load of fabric and place in wheel.
2) Start wheel and add water at about 100°F. The ratio of liquid to cloth should be ½ gallon per lb of cloth for *washing*.
3) Add sufficient soap for running suds.
4) Add steam to bring temperature to a minimum of 95°C (203°F).
5) Run wheel 60 minutes from starting time, *maintaining* temperature at a minimum of 95°C (203°F).
6) Drain wheel.
7) Refill wheel to the proper level with water and raise temperature rapidly to 140°-149°F. The ratio of liquid to cloth should be one gallon per lb of cloth for rinsing. Run 10 minutes at 140°F and drain.
8) Refill wheel with proper level of water and raise temperature quickly to 140°-149°F. Run additional 10 minutes.
9) At the end of the second rinse (80 minutes from start of test), drain wheel.
10) Samples are removed from the wheel, extracted by suitable means to approximately 55% moisture content, and then power pressed.

Method 8: French Method

1) Prepare 15-lb dry load of fabric and place in wheel.
2) Start wheel and add water at about

TABLE II. COMPARISON OF SHRINKAGE RESULTS OBTAINED BY EIGHT LAUNDERING TEST METHODS EVALUATED IN FIVE LABORATORIES

FABRIC #1—DENIM, UNSHRUNK—SHRINKAGE (%)

Laboratory:		I		II		III		IV		V	
Method:		W	F	W	F	W	F	W	F	W	F
1) CCC-T-191a,	3 lb	12.5	0.3	11.8	0.7	12.0	0.8	13.0	0.0	12.7	0.4
		12.2	0.0	12.5	0.7	11.6	0.7	13.2	0.0	11.3	+0.2
2) CCC-T-191a,	8 lb	12.8	+0.5	12.5	+0.2	12.3	1.4	11.1	+0.6	12.1	0.5
		12.8	+0.4	12.3	+0.5	11.3	1.7	11.5	0.0	12.6	+0.2
3) CCC-T-191a,	15 lb	12.5	+0.6	13.0	0.5	11.2	1.1	11.4	+0.7	9.3	0.4
		11.1	+0.1	11.6	+1.2	10.9	1.1	11.8	+0.5	12.3	0.4
4) CCC-T-191b,	3 lb	13.8	0.2	12.7	1.2	12.7	1.7	12.9	+0.3	12.6	0.1
		12.5	0.3	12.3	1.4	12.7	1.7	13.2	+0.2	12.3	+0.3
5) CCC-T-191b,	8 lb	14.5	0.0	12.0	0.5	12.5	1.7	13.0	0.0	12.8	0.3
		13.0	+0.5	12.3	0.9	11.9	1.4	13.4	+0.3	12.1	0.1
6) CCC-T-191b,	15 lb	11.5	+0.2	10.4	0.5	9.1	0.8	11.1	+0.3	10.6	0.1
		11.0	+0.9	10.7	0.9	10.6	0.6	11.9	+0.3	12.2	0.1
7) British,	15 lb	13.3	+0.2	10.4	0.5	12.3	1.3	13.0	+0.3	9.2	+0.3
8) French,	15 lb	12.8	+0.2	12.3	0.7	11.2	1.6	10.2	+0.3	12.2	0.4

FABRIC #1-S—DENIM, SANFORIZED—SHRINKAGE (%)

Laboratory:		I		II		III		IV		V	
Method:		W	F	W	F	W	F	W	F	W	F
1) CCC-T-191a,	3 lb	1.0	+0.5	0.7	0.7	1.4	+0.3	0.3	0.0	0.8	1.5
		1.0	+0.4	2.1	0.0	+1.1	0.1	+1.0	+0.3	0.3	1.1
2) CCC-T-191a,	8 lb	0.2	+0.3	2.5	+0.5	+0.9	0.3	0.3	0.2	0.3	0.9
		0.3	+0.3	1.9	+0.7	+0.8	0.3	+0.7	0.3	+0.3	1.3
3) CCC-T-191a,	15 lb	+0.3	+0.1	1.2	+0.2	+0.3	+0.4	+0.8	0.3	+0.5	0.7
		+0.5	+0.4	2.5	0.0	+0.7	0.3	−0.2	+1.0	0.2	1.1
4) CCC-T-191b,	3 lb	0.8	+0.3	0.9	0.2	0.1	0.7	0.3	0.3	0.5	1.1
		0.2	0.7	1.4	0.5	+0.8	0.9	0.0	0.0	0.5	1.5
5) CCC-T-191b,	8 lb	0.0	0.0	1.9	+0.2	+0.5	0.3	0.7	0.3	0.3	1.3
		1.5	1.1	0.9	+0.5	+1.0	0.3	+0.2	0.0	0.0	1.2
6) CCC-T-191b,	15 lb	0.0	+1.2	+0.5	+0.7	+1.7	0.2	+0.3	+0.2	+0.7	0.8
		0.3	0.5	0.9	0.2	+1.0	0.2	+0.5	0.0	0.3	1.3
7) British,	15 lb	0.3	+0.3	0.2	+0.5	+0.3	0.6	+1.5	+0.7	+1.4	1.5
8) French,	15 lb	0.2	0.0	+0.5	+0.7	1.3	0.3	+1.0	0.0	+0.5	0.5

TABLE III. COMPARISON OF DOMESTIC, COMMERCIAL, AND ROTARY WASHER TYPE LAUNDERINGS THROUGHOUT A TOTAL OF TEN WASHINGS OF DENIM WITH "REGULAR" UNSHRUNK MILL FINISH

Denim—Regular Mill Finish
Fabric No. 1—Shrinkage (%)

Domestic Laundering—18" Specimen

	WARP					FILLING				
Wash No.	1	2	4	6	10	1	2	4	6	10
Set #1	−11.2	−13.0	−14.0	−14.0	−14.4	+1.0	+1.1	+0.8	0	0
	−12.0	−13.4	−14.3	−14.9	−14.4	+0.3	+0.4	0	−0.5	−0.7
	−11.7	−13.1	−13.8	−14.1	−14.5	+1.0	+0.9	+0.8	+0.2	−0.2
	−11.6	−13.2	−14.0	−14.3	−14.4	+0.8	+0.8	+0.5	−0.1	−0.3
Set #2	−11.7	−12.4	−13.6	−14.0	−14.3	+0.7	+0.3	0	−0.8	−0.4
	−12.2	−13.8	−13.7	−14.4	−15.0	+0.3	−0.1	−0.1	−0.6	−0.8
	−11.6	−12.3	−13.3	−12.9	−13.8	+0.7	+0.8	+0.2	0	−0.4
	−11.8	−12.8	−13.5	−13.8	−14.4	+0.6	+0.3	0	−0.5	−0.5
Set #3	−11.6	−12.7	−13.9	−14.5	−14.3	+0.3	+0.3	+0.4	0	−0.3
	−11.7	−13.2	−14.1	−14.6	−14.5	−0.3	0	−0.5	−0.6	−1.2
	−11.2	−12.0	−12.7	−13.8	−13.8	+0.7	+0.6	−0.2	−0.1	−0.4
	−11.5	−12.6	−13.6	−14.3	−14.2	+0.2	+0.3	−0.1	−0.2	−0.6
Mean:	−11.6	−12.9	−13.7	−14.1	−14.3	+0.5	+0.5	+0.1	−0.3	−0.5

Domestic Laundering—10" Specimen

Set #1	−10.0	−11.6	−12.9	−13.6	−12.9	−0.1	−0.4	−0.9	−1.0	−1.3
	−11.4	−12.7	−14.0	−13.2	−14.4	−0.7	−1.0	−1.6	−1.7	−2.1
	−10.4	−12.3	−12.6	−12.3	−13.0	−0.1	−0.5	−1.2	−0.8	−1.7
	−10.9	−12.2	−13.2	−13.0	−13.4	−0.3	−0.6	−1.2	−1.2	−1.7
Set #2	−11.0	−12.4	−13.5	−13.9	−14.1	+1.4	+0.6	+1.1	+0.1	−1.0
	−12.6	−13.7	−14.5	−14.4	−14.9	+0.8	0	−0.3	−1.0	−0.9
	−11.4	−12.9	−13.7	−13.8	−14.0	+1.4	+0.4	−0.5	−0.9	−0.5
	−11.7	−13.0	−13.9	−14.0	−14.3	+1.2	+0.3	+0.1	−0.6	−0.8
Mean:	−11.3	−12.6	−13.5	−13.5	−13.9	+0.5	−0.2	−0.5	−0.9	−1.2

Commercial Laundering

	−11.7	−12.8	−13.3	−13.3	−14.4	+1.1	+1.6	+0.5	+0.5	−0.5
	−12.8	−13.3	−13.9	−13.9	−13.9	+1.1	+0.5	+0.5	0	+0.5
	−12.2	−12.8	−14.4	−14.4	−13.3	−0.5	0	−0.5	−0.5	−2.2
	−12.2	−13.0	−13.9	−13.9	−13.9	+0.6	+0.4	+0.2	0	−0.7

Rotary Washer—CCC-T-191a, 3 lbs

	−12.7	−13.5	−14.6	−14.6	−14.6	+0.8	+0.1	−0.3	−0.5	—
	−12.7	−13.5	−14.6	−14.6	−14.8	+0.3	−0.4	−0.4	−0.5	−0.9
	−12.5	−13.4	−14.2	−14.1	−14.5	+0.6	+0.2	−0.3	−0.7	−1.0
	−12.6	−13.4	−14.3	−14.4	−14.6	+0.6	0.0	−0.3	−0.6	−0.9

TABLE IV. COMPARISON OF DOMESTIC, COMMERCIAL, AND ROTARY WASHER TYPE LAUNDERINGS THROUGHOUT A TOTAL OF TEN WASHINGS OF DENIM WITH SANFORIZED FINISH

Denim—Sanforized Finish
Fabric No. 1-S—Shrinkage (%)

Wash No.	WARP 1	2	4	6	10	FILLING 1	2	4	6	10
Domestic Laundering—18" Specimen										
Set #1	+0.7	+0.2	−0.8	−1.0	−1.9	+1.0	+1.2	+0.4	0	−0.5
	+1.0	+0.2	−1.4	−1.2	−2.0	0	0	−0.6	−0.9	−0.9
	+1.4	+1.5	−0.8	+0.1	−1.5	+0.7	+0.9	+0.7	+0.1	−0.2
	+1.0	+0.6	−1.0	−0.7	−1.8	+0.6	+0.7	+0.2	−0.3	−0.5
Set #2	+1.5	+0.2	−1.0	−0.8	−1.4	+0.3	+0.2	−0.2	−0.6	−0.4
	+0.4	−1.4	−2.2	−1.8	−2.0	0	−0.5	−0.6	−0.7	−1.0
	+1.4	−0.7	−1.0	−0.7	−0.7	+1.3	+0.6	0	0	−0.5
	+1.1	−0.6	−1.4	−1.1	−1.4	+0.5	+0.1	−0.3	−0.4	−0.6
Set #3	+1.4	+0.2	−1.6	−1.0	−1.7	+0.4	+0.4	0	+0.4	−0.2
	+1.1	0	−1.6	−1.6	−2.0	+0.2	0	−0.3	−0.4	−0.7
	+2.2	+0.3	−0.4	−0.8	−1.3	+0.4	+0.3	+0.4	+0.2	0
	+1.6	+0.2	−1.2	−1.1	−1.7	+0.3	+0.2	0	−0.1	−0.3
Mean:	+1.2	+0.1	−1.2	−1.0	−1.6	+0.5	+0.3	0	−0.2	−0.5
Domestic Laundering—10" Specimen										
Set #1	−0.8	−0.6	−1.9	−2.3	−3.2	−0.6	−0.8	−1.6	−2.4	−2.4
	−0.4	−1.4	−2.8	−2.8	−3.0	−1.0	−1.2	−1.8	−2.7	−2.5
	0	−0.4	−1.9	−2.4	−3.1	−1.2	−1.6	−0.9	−1.7	−2.1
	−0.4	−0.8	−2.2	−2.5	−3.1	−0.9	−1.2	−1.4	−2.2	−2.3
Set #2	+0.6	−0.3	−1.6	−1.7	−1.8	0	−0.4	−0.9	−1.0	−0.9
	+0.4	−0.7	−1.9	−1.9	−1.8	−0.3	−1.4	−1.8	−1.8	−1.9
	+1.3	−0.3	−0.8	−1.5	−1.6	+0.4	−0.4	−0.5	−0.7	−1.6
	+0.8	−0.4	−1.4	−1.7	−1.8	0	−0.7	−1.1	−1.2	−1.4
Set #3	+1.2	−0.2	−0.8	−1.4	−2.4	+1.4	+0.5	0	0	−0.8
	+1.0	−0.4	−1.0	−1.7	−2.0	0	+0.1	−0.6	−1.2	−1.3
	+1.4	+0.6	−0.8	−0.4	−0.6	0	+0.4	+0.2	−0.5	−0.3
	+1.2	0	−0.9	−1.2	−1.7	+0.5	+0.3	−0.1	−0.6	−0.8
Mean:	−0.5	−0.4	−1.5	−1.8	−2.2	−0.1	−0.5	−0.9	−1.3	−1.5
Commercial Laundering										
	0	0	−0.5	0	0	−0.5	0	−0.5	−0.5	−1.1
	−0.5	−0.5	−0.5	−1.1	−1.1	0	−0.5	−0.5	−1.1	−1.1
	−0.5	0	0	−1.1	−2.2	+0.5	−0.5	0	−1.1	−0.5
	−0.3	−0.2	−0.3	−0.7	−1.1	0	−0.3	−0.3	−0.9	−0.9
Rotary Washer—CCC-T-191a, 3 lbs										
	+0.4	−0.3	−0.9	−1.5	−2.0	+0.2	−0.5	−1.0	−1.0	−1.6
	−0.8	−0.7	−1.5	−1.8	−1.5	+0.2	−0.6	−1.0	−1.4	−1.4
	−0.5	−0.7	−1.8	−1.8	−1.8	+0.4	−0.4	−0.8	−0.5	−1.0
	−0.3	−0.6	−1.4	−1.7	−1.8	+0.3	−0.5	−0.9	−1.0	−1.3

100°F. The amount of wash solution (or rinse water) should be normal for the machine used, and, in any event, sufficient to cover samples.

3) Add sufficient soap to form running suds.

4) Add steam to bring temperature to a minimum of 95°C (203°F).

5) Run wheel 20 minutes from starting time, while maintaining temperature at minimum of 95°C (203°F).

6) Drain wheel.

7) Fill wheel to proper level with water at 140°F for 10 minute rinse.

8) Thirty minutes from start of test wheel is drained.

9) Refill wheel to proper level with water at about 100°F and repeat steps #2 through #8 four times for a total of five washes and rinses. Samples are removed from the wheel, extracted by suitable means to approximately 55% moisture content, and then power pressed.

DOMESTIC LAUNDERING PROCEDURE

Tests were made in the AATCC Research Laboratories in a Westinghouse Laundromat Automatic Washer, Model L-5. The test specimens were 14" x 14" with 10" distance between markings, and 22" x 22" with 18" distance between markings. All tests were carried out in triplicate.

A three-pound load was used and washings were made at 140°, using 20 grams of Ivory or Lux with each load.

The following comprises one washing cycle:

10 minutes sudsing
2 minutes spray rinse and drain
7 minutes rinse and drain
7 minutes rinse and drain
4 minutes extraction
—
30 minutes total.

After washing, all specimens were dried on a Hoffman flat bed press at approximately 300°-350°F (62 lbs steam pressure), allowed to cool overnight, and measured.

COMMERCIAL LAUNDERING PROCEDURES

Fabrics #1, #1-S: Laundered at LaRue Laundry, Elizabeth, N J

Overalls and colored work clothing load of 175-200 lbs.

42" x 54" rib-type metal wheel.

3-7 minutes sudsing at 145°-150°F with enough prepared soap to produce good running suds. Prepared soap made up in ratio of 7 lbs soap to 4 lbs Pensal (sodium orthosilicate). No bleach used.

4 rinses (first rinse warm, succeeding rinses cold water).

Fabrics #3, #3-S, #4, #4-S: Laundered at Van Doren Laundry, Westfield, N J

White work loads.

3 sudsing operations (from about 115°F in first operation to 150°F in third operation). Bleach added in third sudsing.

4 hot rinses.

Souring and blueing operation.

Fabrics #2, #2-S, #6, #6-S, #7, #7-S, #8, #9CR, #10, #10-S: Laundered at Van Doren Laundry

Light colored load.

Maximum sudsing and rinsing temperature of 120°F.

3 sudsing operations.

4 rinses.

No bleach or blueing.

Soured after rinsing.

Note: All specimens were ironed in all cases, except the last time they were washed. Ironing was done on a flat-bed handkerchief ironer. Before measuring, specimens were wet out, extracted, dried, and conditioned at standard conditions.

RESULTS

Table I gives a comparison of the results obtained on several of the cotton test fabrics with unshrunk regular mill finish when laundered by the eight laboratory test methods and when given a domestic or a commercial washing.

Presented in Tables II, III, and IV are the data obtained in the various tests in the five participating laboratories and in domestic and commercial launderings of two of the sixteen fabrics studied in this investigation. Similar data were obtained on the other fabrics before an analysis of the data was carried out.

Figures 1 and 2 show the close similarity of the results obtained by the various laundering methods on these two fabrics, the differences being only a fraction of one per cent. Similar results were obtained on the other fabrics studied.

ANTISTATIC FINISHES FOR TEXTILES*

MASON HAYEK

Contribution No. 149 from Jackson Laboratory
E I du Pont de Nemours & Co, Inc, Wilmington, Del

The fundamentals of static electricity on textiles are reviewed, and the mechanisms of antistatic action are described. To be generally effective, antistatic agents must reduce the electrical resistance of textile surfaces. The manner in which the electrical resistances of fibers are decreased by various compounds, particularly the commonly used antistatic agents, is discussed.

The requirements and properties of antistatic finishes needed for the manufacture of fibers and fabrics and for the treatment of consumer articles are discussed.

INTRODUCTION

THE serious problems which are due to the accumulation of static electricity on fibers are widely known. Numerous investigators have reported the electrical properties of fibers and the means of measuring static, but few have dealt with antistatic finishes. This paper will describe a theory of antistatic action, consider the relation between antistatic properties and the chemical composition of textile finishes and summarize the required properties of antistatic finishes.

FUNDAMENTALS

First, it is necessary to review briefly the fundamentals of static electricity on textiles. Electrification by friction probably results from the sudden separation of the two halves of a double layer set up on contact *(1)*. The electrification may actually involve the transfer of charged ions rather than electrons across the boundary. After friction of a fiber or fabric with a second surface, the net charge at the point of contact on the textile is the resultant of two factors: the total charge which resulted from the transfer of ions or electrons and the rate of loss of charge from the point of contact, that is, the conductivity of the surface. Each factor must be considered separately. The presence of ions in the air above a charged surface will increase the rate of loss of charge from the surface, but, in the consideration of antistatic agents, we shall assume that the number of ions in the atmosphere is no higher than normal.

The net transfer of charge across the boundary between two contacting surfaces is dependent upon many factors, but a convenient rule of thumb in deciding the direction charges will move from one surface to another is the electrostatic series. One such series is shown in Table I. The substances are so arranged that, whenever two are rubbed together, the one higher in the list assumes a positive charge, while the lower one assumes a negative charge.

For a quantitative measure of the formation of an electrostatic charge on a surface, something must be known of the electrical resistance or conductivity of the surface. The smaller the resistance, the faster a charge will move across the surface and to a ground. If the resistance is small enough, no measurable charge can accumulate at the point of contact.

Thus, there might be two methods by which charge accumulation on a fiber could be prevented when that fiber is brought into contact with a second substance: 1) the fiber could be changed somehow so that it is close to the second substance in the electrostatic series; 2) the fiber could be changed to reduce its electrical resistance to such a low value that no net charge could remain at the point of contact. The first method is obviously unsatisfactory because a fiber will come into contact with a great variety of surfaces. Moreover, a fiber may become charged even by friction with another fiber of the same composition.

It is of interest to note that the electrical charges on a charged textile surface are not distributed uniformly over the surface. This can be shown by using the powder technique of Hull *(2)* for locating areas of relatively positive or negative character. The spotty distribution is probably due to incomplete contact between the surfaces and irregularities in the surface.

TABLE I
ELECTROSTATIC SERIES

Positive End
Glass
Human hair
Nylon yarn
Wool
Silk
Viscose rayon
Cotton
Paper
Steel
Rubber
Acetate rayon
"Dacron" polyester fiber
"Orlon" acrylic fiber
Saran fiber
Polyethylene
Negative End

MECHANISM OF ANTISTATIC ACTION———Antistatic finishes must function by lowering the electrical resistance of the surface of the fibers if the finishes are to have wide utility. Experimental evidence for the mechanism of antistatic action has come from the evaluation of a wide variety of compounds. In every case studied in our laboratories, antistatic agents which were effective on fibers under a variety of conditions reduced the electrical resistances of the fibers by a factor of one hundred to one million at concentrations of the order of one percent on the basis of fiber weight and at a relative humidity of 25 percent.

Two instruments have been useful in the measurement of antistatic action. The Jackson Laboratory static tester *(3)* measures the total charge developed under a given set of conditions and also the rate of decay of the charge. The second instrument, the resistance tester, *(4)*, measures the electrical resistance of fabrics. The measurement of electrical resistance has been shown to be a convenient screening test because it has been established that, if the resistance is low enough, the static properties of the textile will be satisfactory. Data from measurements of test fabrics with the static tester and other instruments correlate well with resistance data. Since the static behavior of cotton is almost never objectionable, it is reasonable to assume that, if the electrical resistivity of a fiber or fabric is significantly lower than that of the cotton fiber or fabric, the static behavior of the test substance will be satisfactory. If the electrical resistivity of the test material is near that of cotton, it is not possible to make a firm prediction of the static behavior, because other factors, such as the position of the substance in the electrostatic series, must then be considered.

The data in Table II show the dependence of static behavior on the electrical resistivities of treated fabrics. The instruments referred to above were used for these and following data. The data for the charges developed are in arbitrary units.

Hearle *(5)* has published an excellent review article on the electrical resistance of textile materials, which discusses methods of measurement as well as test data. Those data likewise show the dependence of static behavior of untreated fibers on

* Presented in the West Ballroom of the Conrad Hilton Hotel, Chicago, Ill, on Sept 18, 1953, before the session on Textile Auxiliaries with N A Ruston presiding. Submitted to the Reporter by the Editor of Proceedings on March 29, 1954.

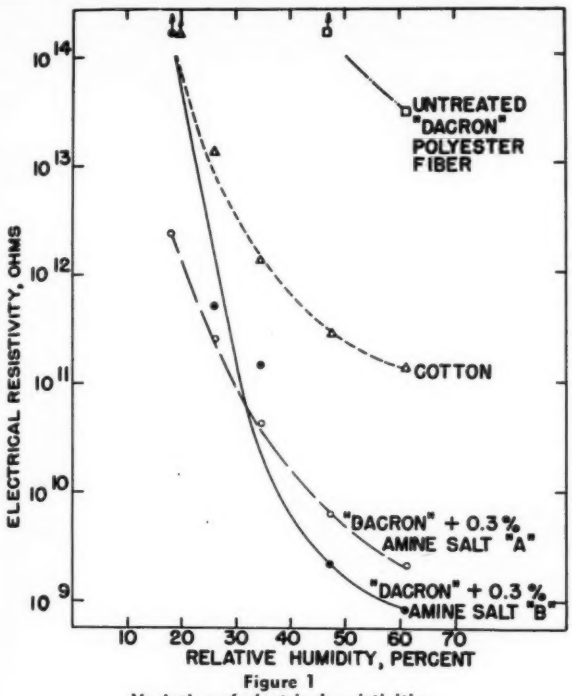


Figure 1
Variation of electrical resistivities with relative humidity

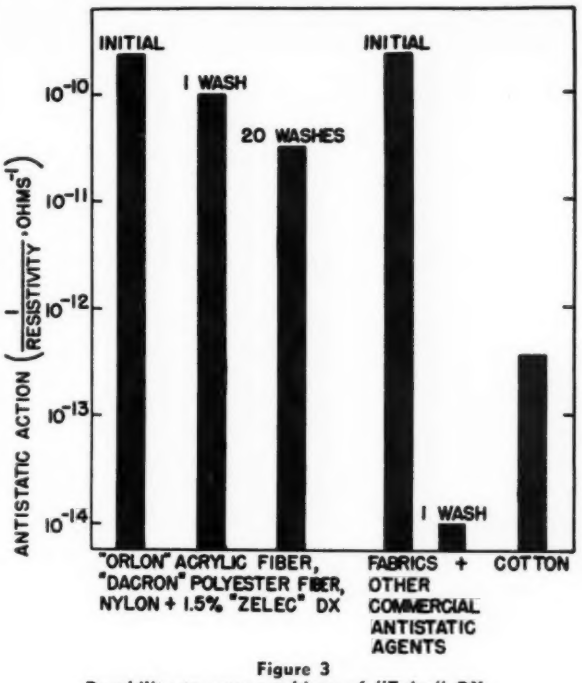


Figure 3
Durability to soap washings of "Zelec" DX antistatic agent

the electrical resistances of the fibers.

All data suggest the view that static electricity is a surface phenomenon. The reduction of electircal resistivity effected by antistatic agents is a reduction of surface resistivity only. Antistatic agents function by decreasing the electrical resistance of the fiber surface, the only portion of the fiber which need be involved in static phenomena. It should be noted that the data of Hersh and Montgomery *(6)*, dealing with the volume electrical resistivities of fibers, apply to pure, unfinished fibers, not to treated fibers.

Before it is possible to design compounds that have antistatic properties, it is necessary to have a suitable hypothesis to explain how antistatic agents can lower the electrical resistivity of fibers. The experimental results with antistatic agents of the types now known in the trade indicate that this reduction is effected by the adsorption of water by the antistatic agent on the fiber surface. Evidence of this mechanism has been obtained from a study of the variation of electrical resistivities of treated and untreated fabrics with variations of relative humidity. Curves of the type shown in Figure 1 are obtained.

The mechanism of conduction of electricity along a surface on which the antistatic-water units are deposited is speculative. The conduction along a film of antistatic agent containing water may be ionic in nature or it may be electronic,

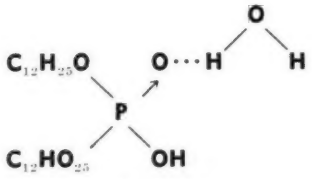


Figure 2
Association of alkyl phosphate with water

as proposed by Baxter *(7)* for the wool-water system. At this time it is certain, however, that the resistance varies inversely with some function of the moisture content of the film.

RELATIONS BETWEEN CHEMICAL STRUCTURE AND ANTISTATIC ACTION

The application of the theory of antistatic action to a number of classes of compounds used as antistatic agents may now be considered. Knowledge of the properties of a sufficiently large group of compounds could lead to an understanding of the relationships between chemical structure and antistatic properties.

The classes of compounds listed in Table III and combinations of these classes are found among the products described as antistatic agents in the patent and trade literature. An example of a compound in each class and references to disclosures are given. Many of the references given in Table III describe antistatic substances that contain more than one type of antistatic group. We shall not consider here those products which counteract the effects of static on fibers or fabrics without actually preventing the accumulation of static. Such an agent, for example, might bind the filaments in a fiber bundle together during the spinning operation even though the bundle accumulated much static electricity.

In our laboratories no evidence has been found which contradicts the theory that for all the classes listed in Table III, the antistatic properties are due to the reduction in surface resistivity of treated fibers by the combination of antistatic agent and water.

In the case of the inorganic salts, the salts that show antistatic properties when padded on fabrics from aqueous solutions are the ones that absorb sufficient water to form a conductive film on the fiber surface. Sodium chloride, which absorbs little water, is not an antistatic agent at low concentration, whereas calcium chloride and lithium chloride, both of which are deliquescent, are effective.

All the other classes in Table III can be grouped together in that their antistatic properties appear to depend upon the ability of a functional group to bind water to the compound. For example, it can be postulated that an alkyl phosphate associates with water at moderate humidities as shown in Figure 2. In some cases more than one water molecule may be bound to a single functional group. Thus,

the system antistatic agent-water on the fiber surface undoubtedly consists of polar centers, each holding up to several water molecules, but it does not necessarily consist of antistatic molecules dispersed in a film of water.

It has been found that an agent which is very effective for one fiber may have only moderate effectiveness on another and may actually increase the static propensity of a third. This is illustrated in Table IV.

Such data indicate that, besides the ability of a compound to absorb water, an important factor in antistatic action is the mode of association of the agent with the fiber. Because the behavior of a given antistatic agent depends upon the structure of the entire molecule and the nature of the fiber treated with the agent, it is not possible to arrange the various classes of antistatic agents in order of effectiveness.

The high resistivity of cotton fabric treated with the agent of Table IV may be due to an association of the polar groups of the antistatic agent with the hydroxyl groups of the cellulose, resulting in an orientation of the nonpolar groups of the antistatic agent away from the fiber. Thus, the fiber surface would actually be made hydrophobic by the antistatic agent.

THE REQUIREMENTS AND PROPERTIES OF ANTISTATIC AGENTS

Antistatic agents must be used to prevent the difficulties encountered with static on some water-insensitive fibers during processing and during some conditions of use by the consumer. At the present time it is most practical to use, first, a nondurable agent which can be applied to fibers or fabric to protect the textiles until the final fabric finishing is carried out and, secondly, a durable agent to prevent static during the period of fabric use.

In the case of the nondurable antistatic agents, it has become apparent that the proper way to find an agent for a particular fiber is practically to tailor-make that agent. A fiber must pass through many operations from the time the finish containing the antistatic agent is applied until it is removed. In this case the finish usually contains a blend of components. The finish must possess a delicate balance of properties, and this balance places rigid restrictions on the antistatic component. As long as the latter is on the fiber, it must show good antistatic properties without seriously offsetting the lubricating effects of the finish. Both fiber-to-fiber and fiber-to-metal friction must be controlled. It must be compatible with finishes and sizes applied subsequently and not alter the properties of those finishes and sizes. Finally, the agent and the finish containing it must be easily removed by washing. It is because of these and other rigid requirements that a good agent for one fiber is not necessarily good for another. The agent should be designed for the fiber, not merely furnished to be fitted into the finish as well as possible. The effectiveness of two nondurable agents is shown in Table V. Both compounds are alcohol phosphates.

Durable antistatic agents are required to prevent static during the period of use of textiles based on water-insensitive fibers. Such an agent must be fairly easily applied to fabrics and must not alter significantly the hand or durability of the fabric. It must provide static protection under a variety of atmospheric

TABLE II
ELECTROSTATIC PROPERTIES OF VARIOUS FABRICS AT 25% RELATIVE HUMIDITY

Fabric	Electrical Resistivity 10^n Ohms	Static Test Data* Charge	Static Test Data* Half-Life Period, Seconds
Cotton	50,000	35	9
Nylon	>1,000,000	135	500
"Orlon" acrylic fiber	>1,000,000	150	300
"Orlon" + 0.05% alcohol phosphate	500	25	3
"Orlon" + 0.10% alcohol phosphate	36	10	<1

* Test fabrics rubbed against untreated nylon fabric.

TABLE III
COMPOUNDS WHICH SHOW ANTISTATIC PROPERTIES

Class	Example	References
Inorganic salts	LiCl	(8), (9), (10)
Esters	$C_{18}H_{37}CO_2C_4H_9$	(11), (12), (13), (14), (15)
Mono- or polyhydric alcohols	$CH_2(OH)\,CH(OH)\,CH_2(OH)$	(11), (16), (17)
Amines	$N(C_2H_4OH)_3$	(17)
Amides	Derivative of $C_{18}H_{37}CON(C_2H_4OH)_2$	(18)
Polyethanoxy derivatives	$C_{16}H_{33}O(C_2H_4O)_nH$	(19), (20), (21)
Carboxylic acid salts	$C_{18}H_{35}OCOCOOH{\cdot}NH_2C_{18}H_{35}$	(11), (16), (22), (23), (24), (25)
Amine and guanidine salts	$H_2N\overset{H}{\overset{\|}{C}}NH_2{\cdot}HOSO_2OC_{18}H_{37}$	(16), (22), (24), (25), (26), (27), (28), (29), (30)
Quaternary ammonium salts	$CH_2(C_2H_5)(C_2H_5)N^+C_{12}H_{25}$ $CH_2(C_2H_5)(C_2H_5)N^+C_{12}H_{25}$ $(C_{12}H_{25}SO_3^-)_2$	(31), (32), (33)
Alkyl phosphates	$C_{12}H_{25}O$, $C_{12}H_{25}O$, O, OH	(34)
Salts of alkyl phosphoric, phosphonic and phosphinic acids	$C_{18}H_{35}P(O)(OH)(OH)$ $N(C_2H_4OH)_3$	(35), (36)

TABLE IV
PROPERTIES OF A SINGLE AGENT ON DIFFERENT FIBERS AT 25% RELATIVE HUMIDITY

Fiber	Electrical Resistivities of Fabrics 10^n Ohms: Untreated Fabric	Electrical Resistivities of Fabrics 10^n Ohms: Fabric + 0.1% Alcohol Phosphate
"Orlon" acrylic fiber	>1,000,000	18
"Dacron" polyester fiber	>1,000,000	190
Cellulose acetate	>1,000,000	5,000
Cotton	50,000	>1,000,000

TABLE V

EFFECTIVENESS OF "ZELEC" NK AND "ZELEC" NE ANTISTATIC AGENTS AT 25% RELATIVE HUMIDITY

Fabric	*Electrical Resistivity 10^9 Ohms*
"Dacron" polyester fiber + 0.05% "Zelec" NK	860
"Dacron" polyester fiber + 0.20% "Zelec" NK	5
"Orlon" acrylic fiber + 0.05% "Zelec" NE	120
"Orlon" acrylic fiber + 0.20% "Zelec" NE	7
Untreated fabrics	>1,000,000

conditions, particularly in cold, dry weather. The ideal compound would be durable to abrasion and to all kinds of washing and dry cleaning for the life of the fabric. This is actually asking a great deal of any textile finish.

To illustrate the properties of a durable antistatic agent, those of duPont's "Zelec" DX may be given briefly. As far as we are aware, this is the first highly effective antistatic finish which is highly durable to laundering with soap solutions. This product, which is a complex organic cationic compound, should fill a widely recognized serious need of the textile finisher. The effectiveness and durability of "Zelec" DX, according to laboratory tests, are shown in Figure 3. Here the average antistatic properties of "Dacron" polyester fiber, "Orlon" acrylic fiber and nylon are indicated initially and after one and 20 washes. The ordinate is the antistatic action, really the reciprocal of the electrical resistivity. The washes were one-half hour washes at 160°F in the presence of 0.5 percent soap. Obviously even after 20 washes, fabrics treated with "Zelec" DX would be expected to accumulate less static charge than cotton. The antistatic effectiveness is decreased by laundering the treated fabrics with solutions containing synthetic detergents, but the original effectiveness is recovered by laundering with a soap solution. No claims are being made for durability to dry cleaning because both good and poor durabilities have been observed under different conditions.

The research on the electrical properties of textiles and on the development of antistatic agents of many kinds for many uses is continuing in numerous laboratories. The problems of the fiber and fabric manufacturers are being solved. Ultimately, sufficient information will have been accumulated to permit designing the best in both durable and nondurable antistatic agents.

ACKNOWLEDGMENT

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(26) Cresswell, A, USP 2,597,708.
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(28) Wizon, I, USP 2,543,539.
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(30) Oxley, H F and Thomas, E B, BP 641,580.
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(33) Oxley, H F, Thomas, E B and Marfitt, H C, BP 607,088.
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DISCUSSION

Author: An antistatic agent must prevent static under a great variety of conditions. A treated fiber, for example, must not develop a charge when it is passed over a steel guide or when it is rubbed against another fiber. For a particular application, of course, it may be sufficient if the antistatic agent works only under the particular conditions in question.

Question: When treated fibers pass over a guide surface, does not some antistatic agent transfer to the guide, so that you don't have to worry so much about the different types of materials?

Answer: That may be true for limited operations. But you have to consider not only the passage of a fiber over a particular guide, you have to consider also the friction of one fiber on another fiber. It may indeed be true in some instances that the application of an antistatic agent to a guide may be sufficient to prevent static formation.

Q: What about durability to drycleaning?

A: We have made no claims for durability to drycleaning. The durability that is obtained is dependent upon the nature of the drycleaning system. Good effects have indeed been obtained for some conditions of cleaning. Some people have asked if nondurability could be caused by the soaps or solvents used in drycleaning. I believe the soaps are primarily responsible.

Q: Is the durability of the antistatic agent on textiles greater when laundering is carried out with nonionic detergents?

A: So far as we know, antistatic agents are stable toward washing with regular soaps, and therefore the laundering of treated fabric need not be limited to washing with nonionics. It is true, however, that the nonionics, when some is left on textiles, contribute to the antistatic effect because they are hydrophylic.

Q: What are the best durable and nondurable antistatic agents for use on nylon and cotton?

A: For durable applications, DP would be satisfactory. For nondurable applications I would suggest the phosphates I mentioned. If you have new fibers or fabrics, you should consider and experiment with all possible agents.

Q: For a blend of nylon and cotton, then, I take it the agents you have mentioned would have no effect on the cotton.

A: I could not say. I want to emphasize, however, that the effectiveness of an antistatic agent is dependent upon the fiber or combination of fibers upon which it is applied.

Q: Have you found in your exploratory work that any one group of agents is predominantly useful?

A: That is difficult to answer directly, because it is dependent upon the number of compounds you can make of a given type.

Q: Does one group have better properties in general than another?

A: No, one group may work better on one kind of fiber, and another on another fiber.

PRACTICAL ASPECTS OF GREASE-WOOL SCOURING*

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I INTRODUCTION

WOOL obtained from domesticated sheep is one of our most valuable textile fibers. During processing it undergoes many intricate physiochemical and mechanical operations. The efficiency of these operations and the quality of the wool produced is of considerable economic importance.

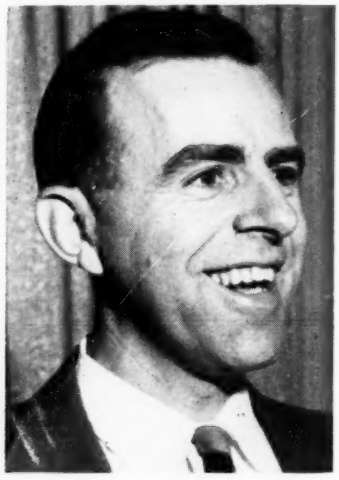
Grease wool, as taken from the sheep, contains a high percentage of impurities, so that one of the first processes is a scouring operation. Unless this scour, which is usually accomplished in an alkali-detergent solution, is carefully controlled, numerous difficulties may arise in subsequent processing. In addition to the quality of the scoured wool, the question of costs and maintenance of production schedules must be considered. Thus, the choice of the scouring system and the attendant detergent and alkali are very important.

There are numerous literature references which describe the scouring process, but only a few have presented details concerning the practical scouring of grease wool. This lack of specific engineering data has prompted this presentation of a detailed account of the process including engineering and cost data from actual production runs.

IMPURITIES IN WOOL——Wool in its raw state contains a variety of impurities, which are either natural, acquired or applied. The natural impurities, wool grease and suint, are glandular products, which coat the wool during growth and protect it from the elements. Manure or blood can also be included in this category. Acquired impurities are generally dust, dirt and vegetable matter, such as burrs. Applied impurities include insecticides and identification tars or paints.

The amounts of impurities vary considerably according to the type and origin of the wool. Analyses of typical wools are as follows:

	% Grease	% Suint	% Dirt	% Vegetable	% Wool
Fine Apparel	20	8	15	1	56
Carpet	5	3	15	2	75



R E Wolfrom

This paper describes, from a practical standpoint, the scouring of grease wool with nonionic detergents. Following a brief statement of the problem, the choice of detergent by laboratory procedures is discussed, and typical commercial plant equipment is described.

The main body of the paper recounts the author's experience in the large-scale scouring of carpet wool and apparel wool. Considerable engineering data are presented on such matters as detergent adds and control measures during the run; cost calculations comparing various detergents are also discussed.

The successful extraction of wool grease and adequate disposal of waste effluents are also mentioned.

Most of the impurities, other than grease, are removed by mechanical means in the opening, dusting, carding and combing operations. Carbonizing of the vegetable matter with acid may be carried out after scouring or dyeing or on the finished yarn or fabric.

The grease and suint, together called yolk, are generally removed by an aqueous alkali-detergent scour, although a few mills have successfully employed a solvent scour to remove the grease followed by a desuinting and rinsing operation.

II THE SCOURING PROCESS

The grease, more properly called wool wax, and the suint are removed by physicochemical means, which involve a two-fold function of saponification and emulsification. Saponification is the chemical process whereby the wool grease combines with alkali to form a soap, while emulsification is a physical phenomenon in which the grease is dispersed in the solution with the aid of a detergent.

WATER——The most important constituent is the water, which dissolves the suint and acts as a vehicle for the alkali and detergent. A generous supply of clean, moderately soft water is desirable.

ALKALI——The alkali saponifies a portion of the grease to form natural soaps and also assists the detergent in emulsifying the nonsaponified portion. Some of the alkalies acceptable for use are sodium and potassium carbonate, ammonia and sodium silicates and phosphates. Of these the cheapest and most effective has been sodium carbonate, or soda ash; however, it is sometimes desirable to include a small amount of silicate or phosphate to overcome the effect of heavy-metal salts, which are likely to cause difficulty in dyeing.

Ofttimes it has been claimed that potassium carbonate or ammonia will produce a softer wool than will soda ash. However, soda ash will produce equivalent results at lower cost, provided concentration and temperature are carefully controlled.

Soda ash produced by the leading manufacturers is nearly chemically pure and is available as a white powder containing 58% sodium oxide, equivalent to 99% sodium carbonate.

DETERGENT——The purpose of the detergent is to emulsify the grease so that it may be floated away from the wool fiber, and to disperse and deflocculate the dirt and other foreign matter. When the grease is dispersed, it is more easily saponified by the alkali. This, coupled with improved emulsification by the detergent on the alkaline side, results in a synergistic action, which produces more efficient grease removal than we

* Presented in the West Ballroom of the Conrad Hilton Hotel in Chicago on Friday morning, Sept 18, 1953, before the Wool Session with Herman Boxser presiding. Submitted to the Reporter by the Editor of Proceedings on April 1, 1954.

could expect from the action of detergent or alkali alone.

EQUIPMENT——The usual equipment involved in wool scouring consists of the following:

1) A duster, which is a cone-shaped heavy beater, to which the wool is supplied through an automatic feeder. The dust created by the machine is discharged out-of-doors. Under the beater are grid bars, through which as the loosened dirt and foreign matter are dropped into the space beneath the machine. This operation opens up the fleece and removes the worst of the dirt and vegetable matter. Often a duster is placed after the dryer to remove vegetable matter.

2) An opener, which consists of a two-cylinder beater and grid bars and an automatic feeder. This machine opens up the stock and removes much of the vegetable matter.

3) The scouring machine consists of four or more cast-iron bowls, or tanks, 20 to 30 feet long and 36 to 48 inches wide. The bowls are equipped with perforated metal trays about one foot below the liquid level. These keep the wool within reach of the rakes and permit dirt to settle into tapered sumps, or hoppers, in the bottom of the bowls. The first bowl is generally filled with warm water only and acts to remove the suint and other water-soluble matter. The second and third bowls contain warm water, detergent and alkali, which remove the worst of the grease and dirt. The fourth and fifth bowls are for rinsing with warm and cold water, respectively.

Each bowl is equipped with parallel raking devices, which gently move the wool forward, and also with a set of squeeze rolls, which express the liquor between bowls and prior to the dryer.

4) The dryer may be a single-apron machine, eight feet wide, on which the wet wool (approximately 50% moisture) is deposited by an automatic feeder and is dried to a normal 12% moisture by warm air blowing through the stock. At the delivery end of the drier the wool is picked up by a fan and discharged into convenient storage bins. As previously mentioned, a duster may be placed in the system just after the drier to remove loosened straw, stones and other gross contaminants.

This equipment line-up may be termed a wool-scouring plant, train or line.

III SCOURING METHODS

Two basic methods of scouring are used in the detergent-alkali process, namely the desuinting and the counter-flow methods. The manner in which the first bowl is utilized is the differentiating factor.

DESUINTING——In this method the first bowl contains water only at a temperature of at least 75°F but not more than 100-110°F, which is the melting point of the grease. Because as much as 40% of the total impurities may be removed in this bowl, the resulting soil build-up necessitates frequent tapping and/or renewal of the bath. This bowl is not connected to the grease recovery system since it contains a negligible quantity of grease.

The second and third bowls contain detergent and alkali at 125-130°F, and it is here that the grease removal is accomplished. Bowl two requires more alkali than bowl three for saponification of the higher grease content. This saponification produces natural soaps, which reduce the amount of detergent required (both in the initial charge and in the adds). The reverse is true in bowl three, where the grease content is lower. These two bowls contain most of the grease and are generally connected to the grease-recovery system, which draws from bowl 2 and returns to bowl 3 with counter-flow between them.

The fourth and fifth bowls are for rinsing and are generally held at 120 and 100°F, respectively. No detergent is necessary, but in some cases it is expedient to add detergent to bowl four to promote removal of any difficult-to-remove grease.

COUNTERFLOW METHOD——The liquor flows counter to the direction of the wool. The overflow from bowls four and five is run back through each preceding bowl and discharged at the beginning of the train at bowl one. Detergent and alkali are used in the first three bowls at 125-130°F, where the scouring takes place. Detergent and alkali are charged and periodically added to all three. The fourth and fifth bowls are reserved for rinsing with water only at 110-120°F.

The grease-recovery system is fed from bowl one and is discharged into bowl 2. This arrangement, as compared with the desuinting method, brings excessive amounts of soil into the system and may result in less efficient grease recovery.

The presence of the suint and grease soaps in the first scouring bowl will buffer the system so that the formation of natural soaps is reduced; this leads to consumption of slightly less alkali and more detergent.

CHOICE OF SCOURING SYSTEM——Experience has shown that the desuinting system is preferable for the finer, higher-grease and higher-suint wool from which grease recovery is profitable. For coarse wool of low grease and suint content the counterflow method is used to better advantage.

This choice, based on experience, is in agreement with the physiochemical reaction taking place in the bowls. As previously discussed, under the counterflow system, the formation of natural soaps is retarded by the suint salts in the presence of alkali and detergent. Thus, desuinting is preferred for fine wool with high suint content. The reverse is true with coarse, low-suint wools.

Grease recovery from the finer high-grease wools is more efficient when the major portions of dirt and suint are removed from the liquor by the use of a suint bowl. In addition, the frequent tapping of the first bowl, necessitated by high soil build-up in the counterflow method, allows considerable grease to go down the drain.

IV SELECTION OF DETERGENT

Until the last fifteen years or so the only detergents used in any appreciable quantity for wool scouring were soaps of animal or vegetable origin. With the commercial development of the "syndets", many found their way into wool scouring. These materials were anionics with high dispersing and fast wetting properties. While they tended, like soap, to exhaust onto the wool, they did not produce rancidity or form heavy-metal soaps. Therefore, they proved useful to a large segment of the industry, even though they were not particularly good emulsifiers for wool grease.

These synthetics showed the following advantages over their predecessors: 1) maintained efficiency in hard water, 2) no lime-soap formation, 3) free rinsing even in cold water, 4) reduced felting, 5) no rancidity or discoloration if left in wool, 6) no resists or splitting during carbonizing, and 7) required less alkali.

In the more recent past nonionic detergents have proved more suitable than the anionics, and certain economies can be effected by their use. Such detergents show improved emulsification over the anionics and in addition are absorbed to a lesser extent on the wool. Further, they are more stable chemically because of their nonionic nature.

Several of the most prominent nonionics of the alkylphenol-ethylene oxide type are now being used in large volume, and, until recently, there have been no specific advances in this field other than economic adjustment of operations. However, there is now available a nonionic detergent specifically designed for wool scouring.

This new material, hereafter designated

TABLE I
REPRODUCIBILITY OF BUCKET-AND-BASKET METHOD

Position in Bag	% Petroleum-Ether Extractables			
	Unscoured	Standard Soap Scour		
Bottom	9.8	.52,	.50,	.51
Center	9.8	.57,	.56,	.41
Top	9.0	.59,	.77,	.52
Average	9.5%	0.55%		

TABLE II
INITIAL CHARGES FOR CARPET WOOL

Bowl No.	Temp °F	Function	Capacity Gallons	Soda Ash			Detergent		
				lb	lb/1000 gal	%[1]	lb	lb/1000 gal	%[1]
1	125	scour	3200	160	50	0.60	1	0.3	0.004
2	120	scour	2500	50	20	0.24	4	1.6	0.019
3	110	rinse	1600	—	—	—	—	—	—
4	100	rinse	1000	—	—	—	—	—	—
5	100	neutralize and bleach	1000	—	—	—	—	—	—

[1] lb/1000 gal multiplied by a factor of 0.012 gives % by weight in solution.

as nonionic B, shows definite superiority over previously used nonionics. The earlier products are exemplified by nonionic A, which is an addition product of nonyl or octyl phenol with 8 to 10 moles of ethylene oxide. Such a material will exhibit, in soft water, a typical cloudiness at approximately 70-80°C. This cloudiness is increased by the presence of salts and alkaline builders because of salting-out effects, which are related to dehydration of the solubilized product.

The new material, nonionic B, shows a higher cloud point in solution, but in the scouring bath containing salts or alkali, its cloud point is substantially lower than that for nonionic A. This reduced solubility under use conditions enables it to become more intimately associated with the greasy wool, so that more efficient grease removal is effected. However, rinsability in the last bowl is not impaired.

LABORATORY TEST METHODS ———The selection of detergent is aided by the use of laboratory test methods. Of course, a full-scale mill run is necessary following acceptable laboratory results.

The AATCC has recently adopted a tentative test method (64-52) for the evaluations of continuous scouring of raw grease wool. In this method carded and spun grease wool is scoured in three beakers equipped with suitable backflow. The residual grease content is then determined by the cup-and-plunger method.

Our method, which we believe more practically simulates mill conditions and can be used with any sample of wool, is similar to those already used in the industry. It is a combination of the counterflow and desuinting systems in that soda ash alone is used in the first bowl.

From a stock of well-mixed grease wool, a 25-g sample is withdrawn and placed in a wire basket, which just fits inside a 10-qt enamelware bucket. The wool is successively immersed for a three-minute period in each of four such buckets in series (simulating the bowls of a scouring train), each bucket containing 5 liters of solution. While the sample is in each bowl, the basket is lifted momentarily free of the solution after one and two minutes elapsed time; this is the only agitation the wool receives. A hand-operated household wringer is used to express the liquor after each bowl.

The standard control train is as follows:

Bowl	Solution	Time minutes	Temp °F
1	0.5% soda ash	3	120
2	0.015% nonionic A[1] 0.25% soda ash	3	120
3	0.005% nonionic A[1]	3	120
4	water only	3	120

[1] Triton X-100, Rohm and Haas Co.

This system may be altered to suit any operating conditions of time, temperature or other variables. Backflow can be simulated by transferring the liquor proportionately between the bowls.

After the rinse, the wool is dried on a screen in a forced-draft oven at 230-240°F. Residual grease is determined by Soxhlet or cup-and-plunger methods.

To show the reproducibility of the test, and incidentally to show the uniform scourability of commercially available wool stock, samples were taken from the top, center and bottom of a fifty-pound bag of opened wool, which happened to be 56's ½ blood Domestic. One-half of each sample was extracted, while the other half was tested for scourability with a soap standard. Data in Table I show the reasonable precision of the test and illustrate the homogeneity of this particular wool. We can, of course, make no claim that all wool will scour this uniformly.

COMPARISON WITH PLANT PRACTICE———Compared with actual practice, the control method simulates 1500 lb/hr of wool in a four-bowl train with an average of 75 lb of wool per bowl containing an average of 1900 gallons of liquor. Chemical charge approximates 40 lb of soda ash and 3 lb nonionic A per 1000 gallons of liquor. By suitable repitition of the method, the soil loading in the bowls can be built to use conditions, and the necessary adds of soda ash and detergent can be made. However, we have found that adds are unnecessary in duplicate or triplicate runs with the same liquor, and that the results correspond to practice without further simulation of actual conditions.

V FULL-SCALE MILL TRIALS

After the selection of a detergent by means of laboratory tests it is necessary to make practical full-scale mill trials. Only in this manner can the running properties and efficiency of a detergent be determined. In addition, the effect of the scour on subsequent operations, such as carding, combing, spinning or dyeing, may be evaluated.

Accordingly, the co-operation of a forward-looking scouring plant is necessary, and, in the trials herein described, the co-operation of the industry is graphically illustrated. Of course, improved efficiency or economy must be demonstrated by the laboratory tests before mill management is willing to make the critical experiment.

In the following sections, two typical, full-scale mill trials are described in detail. Conditions and equipment will vary within the industry but these trials will serve as a general guide to successful scouring.

A) Carpet Wool

EQUIPMENT ——— Carpet wools are for the most part coarse, low in suint and low in grease content. Because of these characteristics the counterflow system was selected for the scouring operation.

The trial under consideration was made with the existing equipment layout, which consisted of an opener, scouring bowls, picker, dryer and duster arranged in the order given. The scouring machine consisted of five bowls, the last of which was reserved for neutralization with sulfuric acid and hydrogen peroxide bleaching. Thus the scouring system was actually a four-bowl line operated according to the following functions and conditions:

Bowl No.	Functions	Average Derived Operating Temp, °F	Gallons Capacity in
1	scour	125	3200
2	scour	120	2500
3	rinse	110	1600
4	rinse	100	1000
5	neutralize and bleach	100	1000

The bowls were equipped with pumps to regulate the backflow as follows: 1) Bowl 4: 400 gal/hr to bowl 3; 400 gal down drain. 2) Bowl 3: 200 gal/hr to bowl 2; 200 gal down drain. 3) Bowl 2: negligible gravity flow to Bowl 1 from difference in liquid levels. 4) Between Bowls 3 and 4 a fresh-water spray of 400 gal/hr was directed into the wool.

Grease recovery was not attempted, because it would be uneconomical with the low-grease wools being scoured.

WOOL BLENDS———The blends in current production were used. This allowed an accurate comparison for efficiency and cost with the detergent in prior use. The wools averaged from 3.7% to 5.0% of solvent extractables for the portions being scoured. The compositions of the blends were as follows:

%	A
12	White Arabi
25	White Kandahar
20	White East Indian
2	Light Grey Kandahar
4	Garnetted White Waste[1]
25	Scoured White China[2]
12	Previously Scoured Blend[2]
100	

%	B
25	White East India
22	White Aleppo
22	White Kandahar
17	Turkish Mohair
12	White Arabi
2	Garnetted White Waste[1]
100	

%	C
41	Pyrenean
20	Yellow Kandahar
10	Yellow Vicanere
6	Red Kandahar
18	Garnetted Dyed Waste[1]
5	Dyed Stock[2]
100	

[1] Contains spinning oils.

[2] Not processed through bowls; added at picker prior to drying.

DETERGENT AND ALKALI——— Detergent stock solutions containing ½ lb of nonionic B per 10-quart pail were prepared by adding the detergent to a portion of warm water and diluting to final volume with cold water. This was added to the front of the bowls as required.

Soda ash was added dry from pails of 10 lb each by dumping onto the immersion tray at the front of the bowls.

INITIAL CHARGES

The soda ash charge averaged about 35 lb/1000 gal with nonionic B at approximately 1 lb/1000 gal. The amounts required in the individual bowls varied with the expected function of the bowl. Data are given in Table II.

Bowl 1 was the first heavy-scouring bowl, and it was rather heavily charged with soda ash. Alkali damage was prevented by careful control of the temperature and by the buffering action of the grease, dirt and suint. Only token amounts of detergent were necessary as a priming charge. Natural soap from the saponification of the grease provided sufficient detergent after the bowl had seasoned.

Bowl 2 was the detergent scouring bowl, and here the alkali was reduced in quantity, while significant amounts of detergent were used. The relatively light soda ash charge maintained the alkalinity, which was partially replenished by the carry-over from Bowl 1.

Bowls 3 and 4 were for rinsing only, and the detergent and alkali carry-over into Bowl 3 from Bowl 2 helped to eliminate the last grease residues.

ADDS

Additions are based on the grease content of the wool and on the feed rate. In general, a feed rate of 1500 lb/hr can be considered average for low-grease, medium-shrinkage blends. In any case, the feed must not exceed the clean-wool capacity of the drier.

Soda ash only was added to Bowl 1 at a rate of 20 lb/1500 lb of wool at approximately 5% grease. This is equivalent to 10 lb of soda ash for 37½ lb of grease. This amount was on the high side since a certain amount of soda ash is adsorbed on the wool and some is converted to bicarbonate by aeration. Ten pound adds were made at ½-hr intervals.

No soda ash was added to Bowl 2 unless the pH dropped or unless a quick adjustment was necessary because of a change in blend or unsettled conditions at the beginning of the scour.

Detergent adds, based on the grease content of the blend, were made to Bowl 2 at a rate of 1 lb/1000 lb of wool. This is equivalent to 1 lb of nonionic B per 75 lb of grease. This was split so that ½ lb was added every half hour.

No detergent was fed to Bowl 1 except the priming charge prior to seasoning of the bowl.

The final schedule of additions was as follows:

TABLE III

SCOURING DATA SHEET FOR CARPET BLENDS WITH NONIONIC B

Feed Rate of Wool: 1500 lb/hr

Elapsed Time in Hours	% Grease	Soda Ash B 1	Soda Ash B 2	Nonionic B B 1	Nonionic B B 2	Remarks
0	—	160	50	1	4	Initial charge
1	0.48	—	—	—	—	
2	0.44	—	—	—	—	
3	0.48	10	—	—	½	Adds are in pounds of soda ash or detergent
		10	—	—	½	
4	0.52	10	—	—	½	Dump 100 gal sludge in B 1
		10	—	—	½	
5	0.68	20	—	½	½	
		10	—	—	½	
6	0.36	10	—	—	½	
		10	—	—	½	
7	0.36	10	—	—	½	
		10	—	½	½	Dump 100 gal in B 1
8	0.45	10	—	—	½	Change B 3 & B 4
		10	—	—	½	
9	0.38	10	—	—	½	
		10	—	—	½	
10	0.68	20	10	—	½	Acid-dyed waste blend started
		10	—	—	½	
11	0.54	15	—	—	½	
		10	—	—	½	
12	0.43	20	—	½	½	Dump 100 gal sludge in B 1
		10	—	—	½	
13	0.36	15	—	—	½	
		10	—	—	½	
14	0.38	15	—	—	½	Normal blend resumed
		10	—	—	½	
15	0.32	10	—	—	½	
		10	—	—	½	Dump 100 gal sludge in B 1
16	0.40	20	—	½	½	Change B 3 & B 4
		10	—	—	½	
17	0.28	10	—	—	½	
		10	—	—	½	
18	0.30	10	—	—	½	
		10	—	—	½	
19	0.28	10	—	—	½	
		10	—	—	½	
20	0.25	20	—	½	½	Dump 100 gal sludge in B 1
		10	—	—	½	
21	0.29	10	—	—	½	
		10	—	—	½	
22	0.30	10	—	—	½	
		10	—	—	½	
23	0.35	10	—	—	½	

	Soda Ash		Nonionic B	
	B 1	B 2	B 1	B 2
Hour	10	—	—	½
½ hour	10	—	—	½
Hour	10	—	—	½
½ hour	10	—	—	½
Totals/hour	20 lb			1 lb
Totals/1500 lb wool, 2 x 10 = 20 lb			2 x 0.5 = 1 lb	

As shown in Table III, it is sometimes necessary to make corrections when grease extractibles rise above the desired value, which was 0.50% in this case.

EXTRA ADDS

1) Tapping of Bowl One. From reference to the chart it may be observed that no adds were necessary for the first two hours. After four hours' running, the sludge was tapped off in Bowl 1, and the volume was made up with fresh water. This made it necessary to add extra soda ash and detergent. This was done every four hours in the middle of the shift. After 8 hours, Rinse Bowls 3 and 4 were changed. Extractables dropped lower with this change but went up again because of a change in blend, which contained portions of acid-dyed waste.

2) Acid-dyed Waste. A portion of the dyed waste was titrated with 0.01 normal NaOH solution and by suitable calculation it was determined that slightly more than 3 lb of soda ash was required to neutralize the acid in 1000 lb of the wool. Accordingly, we raised the soda ash feed by 5 lb/hour in Bowl 1.

After these extra adds the suds in Bowl 1 became more stable, and the extra adds were continued until a normal blend was begun again at 14 hours elapsed time.

3) Sweetening. At 16 hours the suds in Bowl 1 were low, and so an extra add was made.

At the end of the third shift the bowls were all steady, and adds were continued on the basis of the experience gained.

DATA AND DISCUSSION

1) Scouring Formulas and Costs. The data for nonionic B are compared in Table IV with those for the previously used fatty-acid soap. Here the cost data for nonionic B at 36¢ per lb are compared with the previously used soap at 19¢ per lb. They show that nonionic B will scour at a cost of $0.60/1000 lb of wool compared with $1.10 for the fatty acid soap, a saving of 45%.

Detailed data in Table V show the required cost calculations. For convenience the soda ash was assigned a top price of $0.02/lb.

2) Summary. The scoured wool showed better than normal behavior, gave less scum in the dye kettles and the shades were cleaner. Carding and spinning operations showed normal behavior.

These results were achieved with nonionic B at a saving of $0.05/100 lb wool over the fatty acid soap in prior use.

B) Apparel Wool

EQUIPMENT——Fine apparel wools for the production of wool top are best scoured by the desuinting system, which consumes less detergent and permits more efficient grease recovery.

For the trials under consideration the sequence of operation is best illustrated by a brief description of the method and equipment. The fleeces were trap-sorted and dropped loose into bins, from which a conveyor belt carried the wool into openers at the front of the scouring machine. After scouring, the wool was dried on an apron dryer to about 15% moisture and blown into bins in the card room.

The function, temperature and capacity of the scouring machine was as follows:

Bowl No.	Function	Average Derived Operating Temp, °F	Capacity in Gallons
1	suint	75	3200
2	scour	130	3200
3	scour	130	2000
4	scour	120	1800
5	rinse	100	1400

All bowls were equipped with circulating pumps with the counterflow system reduced to approximately 100 gal/hr. The centrifugal grease-recovery system drew from Bowl 2 and returned to Bowl 3. This promoted backflow from Bowl 3 to Bowl 2. A fresh-water spray hit the wool at the nip at the end of Bowl 5 (approximately 400 gal/hr).

The feed rate averaged 1500 lb/hr, depending on shrinkage and dryer capacity.

WOOL BLENDS——The wools to be scoured were represented by the following blends:

%	A
50	Domestic AA
30	Manchester Pieces 58's
20	Territory
100	

TABLE IV
SCOURING CHARGES AND ADDS FOR SCOURING CARPET BLENDS

Feed Rate of Wool: 1500 lb/hr

In Pounds	Fatty Acid Soap		Nonionic B	
	B 1	B 2	B 1	B 2
Initial Charge:				
Soda ash	160	25	160	50
Detergent	—	24	1	4
Hourly Adds:				
Soda ash	16	12	20	—
Detergent	—	4	—	1
Tapping of Bowl 1:				
Soda ash	10	—	10	—
Detergent	4	—	½	—
Cost/1000 lb Wool:				
Initial charge	$0.047		$0.033	
Feeds/1000 lb wool	0.893		0.507	
Tapping of Bowl 1:	0.163		0.063	
Total Cost/1000 lb wool	$1.103		$0.603	

TABLE V
DETAILED COST DATA FOR WOOL SCOURED WITH FATTY ACID SOAP AND NONIONIC B

	Fatty Acid Soap				Nonionic B			
	Pounds	Cost/lb	Total	Unit Cost per 1000 lb Wool	Pounds	Cost/lb	Total	Unit Cost per 1000 lb Wool
Initial Charge:								
Soda ash	185	$0.02	$3.70	$0.0206	210	$0.02	$4.20	$0.0233
Detergent	24	0.195	4.68	0.0260	5	0.36	1.80	0.0100
(180,000 lb wool/week)			$8.38	$0.0466			$6.00	$0.0333
Hourly Adds:								
Soda ash	28	$0.02	$0.56	$0.373	20	$0.02	$0.40	$0.267
Detergent	4	0.195	0.78	0.520	1	0.36	0.36	0.240
(1500 lb wool/hour)			$1.34	$0.893			$0.76	$0.507
Tapping of Bowl 1:								
Soda ash	10	$0.02	$0.20	$0.033	10	$0.02	$0.20	$0.033
Detergent	4	0.195	0.78	0.130	½	0.36	0.18	0.030
(every 6000 lb wool)			$0.98	$0.163			$0.38	$0.063

%	B
20	Australian
15	Montevideo
17	Texas, Calif 56's
36	Pulled
12	Gilled Top
100	

%	C
22	Pulled Domestic
78	Texas, Calif 56's
100	

The gilled top in Blend B was not scoured, it was blended in the dryer after the other portions were scoured. Hexane extractables, for the unscoured mixture (less gilled top), by Soxhlet method were 14.47%; alcohol extractables ran 2.14% for a total of 16.61% solvent solubles.

Blend A averaged 17.67% hexane extractables and 2.01% alcohol for a total of 19.68%, while Blend C showed 13.01% and 2.38% for a total of 15.39%.

DETERGENT AND ALKALI——— Stock solutions were prepared to contain 14.6 lb/100 gal of nonionic B; this concentration was selected to produce 0.8 lb of detergent per unit charge from 5.5-gallon detergent tanks located on the bowls. In like manner, unit charges of 10 lb of soda ash each were provided by measuring, from a 5.5-gallon tank, a solution containing 183 lb per 100 gallons.

INITIAL CHARGES

The soda ash charge averaged 23 lb/1000 gal, while the detergent was about 1.33 lb/1000 gal. The starting formulations are shown in Table VI, where lb/1000 gal have been converted to % by weight.

The amounts necessary in the individual bowls varied according to the expected function of the bowl.

Bowl 1 was a plain water setup with no soda ash or detergent. Here the soluble suint salts and earthy matter were largely removed.

Bowl 2 was the first scouring bowl, and only medium charges of soda ash and detergent were used. The soda ash charge was kept low in Bowl 2 because of the absence of protective buffering action of the suint salts. The suint and natural soaps are not present to provide protective buffering action as in a counterflow system not employing a suint bowl. In addition, Bowl 2 fed the grease plant, and it was advisable to employ as low a concentration of scouring aids as possible to prevent excess foam in the centrifugal recovery system.

Bowl 3 was the second scouring bowl, wherein a somewhat heavier soda ash charge was permissible because of the presence of bicarbonates and saponified wool grease, which exerted a buffering action. The spent liquor from the recovery system flowed into this bowl, which promoted counterflow into Bowl 2. Thus, after a reasonable operating period the liquor in Bowls 2 and 3 reached a certain equilibrium, which was only disturbed by the wool and chemical feeds. The circulating liquor had a high buffering capacity by this time and this seasoning of Bowl 2 prevented alkali damage to the wool.

Bowl 4 was also a scouring bowl but was not connected to the recovery system. It served to remove the hard-to-scour grease residues. The wool at this point contained 0.80% or less grease, which was reduced to 0.50% (Soxhlet) upon rinsing in the final bowl.

Bowl 5 as previously mentioned above was for rinse only and contained water at 100°F. This low temperature tends to reduce nep formation, although some mills prefer a higher temperature to allow for increased drier efficiency or capacity.

ADDS

Soda ash adds were arranged so that 50 lb (or 5 unit charges of 10 lb each) were added for each 1500 lb of wool at 15% grease content. This is equivalent to 22.2 lb of soda ash/100 lb grease. These adds were arranged so that one unit charge (10 lb) was added to Bowls 2, 3 and 4 on the hour and to Bowls 2 and 3 on the half hour.

Detergent adds were arranged so that one unit charge (0.8 lb nonionic B) was added to Bowls 2 and 3 on the hour and to Bowl 3 only on the half hour. This arrangement placed the detergent at the furthest point from the grease plant to which both Bowls 2 and 3 were connected. The counterflow between these bowls allowed for reuse of any excess detergent added to Bowl 3. The carryover on the wool was sufficient to maintain the detergent concentration in Bowl 4.

However, we found that the liquor in the recovery system when heated to 180-190°F, would foam excessively in the storage tank. To eliminate this bothersome factor, the add schedule was changed so that the Bowl-2 adds were alternated with adds to Bowl 4, where the liquor did not enter the centrifuge.

The final addition schedule was as follows:

	Soda Ash			Detergent		
	B 2	B 3	B 4	B 2	B 3	B 4
Hour	1	1	1	1	1	1
½ hour	1	1	—	—	1	—
Hour	1	1	1	—	1	—
½ hour	1	1	—	—	1	—
Hour	1	1	1	1	1	1
Total/hr:	5 unit charges			3 unit charges		
Total/1500 lb wool:	5 x 10 = 50 lb			3 x 0.8 = 2.4 lb		

EXTRA ADDS

Aside from the original or revised feed schedule, it was sometimes necessary to make further adjustments to maintain the cup-and-plunger extractibles at 0.15% or less. The need for these adds is best illustrated on a typical work sheet.

By reference to Table VII the points at which the adds were changed can readily be distinguished. Here we find various reasons why extra adds were necessary; these will be discusssed separately.

1) Grease Plant. Prior to centrifuging, the liquor from Bowl 2 is heated to 160-180°F in a 1000-gallon supply tank. The tank is charged initially with water, and, when the grease has built up in the scouring bowls, the circulating system is cut in. This dilutes Bowl 3 and, in turn, Bowl 2 and causes a loss in scouring efficiency until equilibrium is reached between the recovery and scouring system.

This effect can be seen in Table VII where, after 3 hours, the grease plant was cut in and the extractables rose to 0.55%. As a corrective measure the soda ash adds were doubled. These adds were necessary for a total of three such adds before the two systems came to equilibrium. We can thereby estimate the flow to the grease extractor to be approximately 300 gal/hr.

At 7 hours the extractables began to drop and after 9 hours were an acceptable 0.15%.

When several trains are connected to a single grease plant, this jump in extractables may be repeated when the other trains are cut in. However, the increase is more readily overcome by one double addition as shown by the extra adds at 9 hours' running time.

2) Operator Preference. Operators who have had most of their experience with anionic detergents derived mainly from natural fats and oils will sometimes double the adds when they come in at the beginning of a shift. This insures them against omission of the previous adds by the original operator and, in their parlance, "sweetens" the bowls and prevents them from going "flat". This procedure should be discouraged. The table shows this type of add after 16 hours running and we have written it off as "habit only".

DATA AND DISCUSSION———

1) Scouring Formulas and Costs. In Table VIII the data for nonionic B has been compared to that for nonionic A, both at 36¢ lb and a fatty acid EO ester type at 28½¢ lb. Nonionic B produced a savings of 30% over the fatty acid—EO type and 14% over nonionic A. It is evident that nonionic B is a very efficient detergent, as these runs of over one million

TABLE VI
INITIAL CHARGES FOR APPAREL WOOL

	Temp, °F	Function	Bowl Capacity	Soda Ash lb	Soda Ash lb/1000 gal	Soda Ash %	Detergent lb	Detergent lb/1000 gal	Detergent %
Bowl 1	75	suint	3200	—	—	—	—	—	—
2	130	scour	3200	60	19	0.23	4.0	1.25	0.015
3	130	scour	2000	60	30	0.36	3.2	1.60	0.019
4	120	scour	1800	40	22	0.27	2.4	1.33	0.016
5	100	rinse	1400	—	—	—	—	—	—

TABLE VII
SCOURING DATA SHEET FOR APPAREL BLENDS WITH NONIONIC B
Feed Rate of Wool: 1500 lb/hr

Elapsed Time in Hours	% Grease	Soda Ash B2	Soda Ash B3	Soda Ash B4	Nonionic B B2	Nonionic B B3	Nonionic B B4	Remarks
0		6 1	6 1	4	5	4 1	3	Initial charge. Adds are in units of 5½ gal, or one tank
1	0.10	1 1	1 1	1	1	1 1		One tank = 0.8 lb detergent One tank = 10.0 lb soda ash
2	0.20	1 1	1 1	1	1	1 1		
3	0.55	2 1	2 1	2	1	1 1		Grease plant cut in
4	0.40	2 1	2 1	2	1	1 1		
5	0.30	2 1	2 1	2	1	1 1		
6	0.25	1 1	1 1	1	1	1 1		
7	0.25	1 1	1 1	1	1	1 1		
8	0.15	1 1	1 1	1	1	1 1		Line 2 cut in
9	0.35	2 1	2 1	2	1	1 1		
10	0.10	1 1	1 1	4	1	1 1	3	Change B4
11	0.15	1 1	1 1	1		1 1		
12	0.15	1 1	1 1	1	1	1 1	1	Add in B2 shifted to B4 every other hour to reduce foam in grease plant.
13	0.15	1 1	1 1	1		1 1		
14	0.15	1 1	1 1	1	1	1 1	1	
15	0.15	1 1	1 1	1		1 1		
16	0.15	2 1	2 1	2	2	2 1	2	Extra add to "sweeten" bowls (habit only)
17	0.15	1 1	1 1	1		1 1		
18	0.15	1 1	1 1	1	1	1 1	1	Stop 10 min for repairs
19	0.15	1 1	1 1	1		1 1		Stop 40 min for repairs
20	0.10	1 1	1 1	1	1	1 1	1	
21	0.10	1 1	1 1	1		1 1		
22	0.15	1 1	1 1	1	1	1 1	1	
23	0.15	1	1	1		1		
Average	0.15							

TABLE VIII
SCOURING CHARGES AND ADDS FOR SCOURING RATE OF 1500 lb/hr
SUINT SYSTEM—WATER ONLY IN BOWL 1

In Pounds	Fatty acid: EO Ester B2	Fatty acid: EO Ester B3	Fatty acid: EO Ester B4	Nonionic A B2	Nonionic A B3	Nonionic A B4	Nonionic B B2	Nonionic B B3	Nonionic B B4
Initial charge:									
Soda ash	60	60	40	60	60	40	60	60	40
Detergent	6	6	4	6	6	4	4.0	3.2	2.4
Hourly adds:									
Soda ash	40	20	20	20	20	10	20	20	10
Detergent	1	2	1	1	2	0	0.8	1.6	0
Dump and recharge Bowl 4:									
Soda ash	—	—	40	—	—	40	—	—	40
Detergent	—	—	4	—	—	4	—	—	2.4
Cost/1000 lb wool:									
Weekly initial charge	$0.0431			$0.0498			$0.0370		
Daily recharge, Bowl 4	0.1620			0.1870			0.1470		
Hourly adds	1.8270			1.3860			1.2330		
Total	$2.0321			$1.6428			$1.4170		

pounds each have indicated.

Detailed cost calculations are given in Table IX, where actual detergent cost is on delivered basis while soda ash was assigned a price of $0.02/lb.

2) Summary. Well over one million pounds of scoured wool showed normal behavior and, in certain instances, represented an improvement over previous scouring agents.

Hexane extractables by cup-and-plunger method average 0.15%; Soxhlet was 0.51%. This was in the best working range for carding, spinning and dyeing. The mill was well satisfied with the results, which pointed the way to the establishment of a more efficient scouring system.

Grease recovery by centrifugal method was not hindered by use of nonionic B, and the quantity and quality of the grease was unchanged. This is quite important to some mills where grease sales amount to over one hundred thousand dollars a year. The waste liquors from all bowls and from the grease plant were processed without difficulty by a calcium chloride waste-disposal system.

Upon *carding* we found that more than the usual amount of vegetable matter was falling out. This beneficial effect was probably due to the absence of adsorbed detergent residues so prevalent with anionic fatty acid products. Such a detergent residue will increase the incidence of vegetable matter in the card sliver.

The *nep count* of the top remained unchanged over competitive scouring systems. It is unlikely that the detergent influences nep formation to the same extent as other mechanical factors. For example, lower temperatures in the final rinse bowl will tend to reduce neppiness, while maladjustment of card speed, distance between feed rolls and licker-in, and action of the dividers all tend to increase neps.

Nonionic B was also used in *backwashing* the card sliver prior to the first gilling and oiling operation. This backwash removes any acquired or concealed impurities and further relaxes the fiber after carding. In place of 0.05% anionic detergent we substituted 0.025% nonionic B. The improved rinsability of the neutral nonionic promoted a cleaner top with a pH of 9.3 to 9.5, whereas previous anionic detergents had given less cleaning and a pH above 10. In addition, detergent cost for a four-hour run was reduced from 9.6¢ to 7.2¢ per machine.

Combing data showed no change in noil production.

Costs were substantially reduced as previously shown.

TABLE IX
DETAILED COST DATA PER 1000 lbs WOOL SCOURED WITH THREE NONIONICS

	Fatty Acid: EO ester				*Nonionic A*				*Nonionic B*			
	Pounds	*Cost/lb*	*Total*	*Unit cost per 1000 lb of wool*	*Pounds*	*Cost/lb*	*Total*	*Unit cost per 1000 lb of wool*	*Pounds*	*Cost/lb*	*Total*	*Unit cost per 1000 lb of wool*
Initial charge:												
Soda ash	160	$0.02	$3.20	$0.0178	160	$0.02	$3.20	$0.0178	160.6	$0.02	$3.20	$0.0178
Detergent	16	0.285	4.56	0.0253	16	0.36	5.76	0.0320	9.6	0.36	3.46	0.0192
(180,000 lb wool/week)			$7.76	$0.0431			$8.96	$0.0498			$6.66	$0.0370
Hourly adds:												
Soda ash	80	$0.02	$1.60	$1.067	50	$0.02	$1.00	$0.666	50	$0.02	$1.00	$0.660
Detergent	4	0.285	1.14	0.760	3	0.36	1.08	0.720	2.4	0.36	0.86	0.573
(1500 lb wool/hour)			$2.74	$1.827			$2.08	$1.386			$1.86	$1.233
Recharge Bowl 4:												
Soda ash	40	$0.02	$0.80	$0.067	40	$0.02	$0.80	$0.067	40	$0.02	$0.80	$0.067
Detergent	4	0.285	1.14	0.095	4	0.36	1.44	0.120	2.4	0.36	0.86	0.080
(12,000 lb wool each shift)			$1.94	$0.162			$2.24	$0.187			$1.66	$0.147

VI CONCLUSION

We have discussed working examples which concern two broad types of wool. Within these types there exist many variations in the type and amount of impurities, and blending produces further infinite variation. This variability is further extended by differences between mills which may require changes in the process or even in the choice of nonionic.

The foregoing discussions have been presented in some detail for the benefit of those persons directly concerned with the scouring process. For general information a shorter account might have been preferable. However, it is sufficient to indicate the following: 1) careful control of the scouring process is necessary, 2) the choice of system and chemicals is of the utmost importance, and 3) the scour is a physicochemical engineering process, in which experience and strict adherance to chemical principles is essential.

VII ACKNOWLEDGMENT

The writer wishes to thank the management of the Rohm and Haas Company for permitting the release of certain data contained herein.

Appreciation is also extended to A C Nuessle for his many helpful suggestions during preparation of the manuscript.

VIII DISCUSSION

Question: Have you noticed any difference in the efficiency with which soap and synthetics remove paint from grease wool?

Answer: Unfortunately, no, because, in all the scouring that I have followed, the wool containing paint has been removed for resale or for separate treatment by people expert in that field.

Q: Do you recommend that the first bowl of five for scouring apparel wools be a suint bowl?

A: Yes, especially if the recovery of grease is profitable. One rinse bowl, the fifth, is enough. Detergent can also be added to the fourth bowl because it will be rinsed out in Bowl 5.

Q: Do you recommend the use of the first bowl for suint only when the grease is to be recovered?

A: Any detergent should be as far away as possible from the grease-recovery plant. If extractables are running high in Bowl 4, detergent can be added to Bowl 4 as I have already suggested.

Q: What method of grease recovery are you referring to; and do you have any figures on the relative efficiencies of recovery from a desuinting bowl and the countercurrent system?

A: We used a G-4 centrifuge with a No. 2 ring-dam. The residues from that went into a series of five centrifuges, which brought the grease down to practically a USP standard, which would sell as grade A. The color of the grease was lighter when a nonionic was used than for soap.

As for relative efficiencies, we recovered two barrels more of grease per million pounds of wool with nonionic scouring and a suint bowl than were recovered previously without a nonionic detergent when the countercurrent system was employed. With grease at 17 cents per pound, two barrels amounts to enough to pay for the operator of the grease plant. This is important to a cost-conscious front office.

Q: What percentage of the grease was recovered?

A: Fifty-five percent.

Q: Isn't that rather high?

A: I relied on the mill chemist, whose ability I respect, for those figures.

Symposium——

(Concluded from Page P361)

J Wallace Logan, Springs Mills
Thomas O'Brien, Textron and Bates Piece Dye Works
Royce Pharr, U S Finishing Co
Neil Quinn, Sayles Bleacheries
John E Reeves, Reeves Bros, Inc
S H Rose, Celanese Corp of America
Walter Ross, Rosewood Fabrics
Charles H A Schmitt, Sandoz
Walter Scholler, American Viscoe Corp
Carl Setterstrom, Union Carbide & Carbon
Arthur L Singer, Pacific Mills
Andrew J Sokol, J P Stevens Co
Harry C Spatz, Geigy Chem Corp
Harold J Starke, Hesslein & Co
Robert Stutz, Better Fabrics Testing Bureau
Raymond Trimpert, Frank H Lee Hat Co
John Warner, D B Fuller & Co
Edw Wilkinson, National Assoc Wool Mfrs
Benjamin Woods, American Rayon Institute

SECOND ROW—
William D Appel, U S Bureau of Standards
George L Baxter, Bradford Dyeing Assoc
Robert N Armour, American Aniline Products, Inc
John Hennessey, Berkshire Color & Chemical Co
Kenneth Howry, Fairchild Publications
George A Jonic, American Cyanamid Co
Norman A Johnson, Howes Publishing Co, Inc
Charles Seibert, AATCC Research Associate

Minutes——

190th COUNCIL MEETING*

THE Council held its 190th meeting at the Hotel Plaza, New York, N Y, on Friday morning, January 22, 1954. Present were President J Robert Bonnar, presiding; George L Baxter, Samuel L Hayes and George O Linberg, vice presidents; Albert E Sampson, treasurer; Leonard S Little, chairman of the Executive Committee on Research; Carl Z Draves, Thomas R Smith and P J Wood, past presidents; Elmer E Fickett, Ernest R Kaswell and John P Ploubides representing Northern New England; Ernest J Chornyei, Raymond W Jacoby, Thorwald Larson and Edward W Lawrence representing Rhode Island; Raymond J Carey representing Western New England; Albert E Herrmann, Jr representing Hudson-Mohawk; Matthew J Babey, Weldon C Helmus, Paul J Luck, James J Marshall and Henry L Young representing New York; Carleton T Anderson, Ange E Raimo, Percival Theel and Frederick V Traut representing Philadelphia; Walter M Scott representing Washington; Harley Y Jennings and Raphael E Rupp representing Piedmont; S Jack Davis and C Russell Gill representing Southeastern; Arthur T Brainerd and Samuel Klein representing Mid-West; Kenneth H Barnard of the Committee on Conventions; William A Holst of the Committee on Constitution and Bylaws; George H Schuler and Glenn D Jackson Jr of the Publicity Committee; Harold W Stiegler, research director; I Hahn Godlove, Herman E Hager, Arthur A Janszen and Edgar D Smith; and Harold C Chapin, secretary.

The secretary's report of the 189th Council meeting and financial report of December 31, 1953, and the treasurer's report of January 8, 1954, were accepted.

Committees were appointed, or stand, as follows:

Executive Committee on Research

L S Little, *chairman;* C W Dorn, *vice chairman;* G D Jackson, Jr, *secretary;* J R Bonnar, J N Dalton, R W Jacoby, H Y Jennings, W M Scott, C N Rabold, C A Sylvester, J A Woodruff.

Technical Committee on Research

C W Dorn, *chairman;* Others as before.

Publicity

G H Schuler, *chairman;* G D Jackson, Jr, *vice chairman;* and the chairmen of publicity committees appointed by local sections.

Appropriations

A E Sampson, *chairman;* H C Chapin, C Z Draves, T R Smith, P J Wood.

Membership and Local Sections

S L Hayes, *chairman;* G L Baxter, H C Chapin, J H Jones, G O Linberg.

Corporate Membership

A E Johnson, *chairman;* W B Amos, J Anderson, E B Brearley, W F Brosnan, E A Chevrette, A A Curt, M Harris, J H Hennessey, W H Jaeger, H J Jordan, Jr, R A Shimp, R B Taylorson, F L Wilhelm.

Constitution and Bylaws

H C Chapin, *chairman;* W A Holst, Jr, P Theel.

Technical Supplies

H C Chapin, *chairman;* J R Bonnar, L S Little, A E Sampson, H W Stiegler.

Publications

P Theel, *chairman;* J R Bonnar, W H Cady, H C Chapin, C Z Draves, R W Jacoby, H Y Jennings, N A Johnson, P J Luck, G H Schuler, C A Whitehead.

Bibliography

W H Cady, *chairman;* Others as listed in 1953 Year Book.

Colour Index Editing

W H Cady, *chairman;* G H Schuler, *secretary;* W D Appel, J R Bonnar, W A Holst, R W Jacoby, E I Stearns.

Colour Index Marketing

A E Sampson, *chairman;* G H Schuler, *secretary;* W H Cady, H C Chapin, C W Dorn, G D Jackson, Jr, R W Jacoby, P Theel.

Conventions

K H Barnard, *chairman;* E W Camp, W F Fancourt III, S L Hayes, R W Jacoby, C R Gill, J H Jones, P J Kennedy, G O Linberg.

Perkin Centennial Committee

R W Jacoby, *chairman;* W D Appel, K H Barnard, J R Bonnar, M A Dahlen, S L Hayes, H F Herrmann, A E Sampson.

Technical Programs

W M Scott, *chairman;* L Smith, R H Souther, K S Campbell, R E Rupp, W F Luther, J C Whitt, J L Taylor, C R Gill.

Intersectional Contest

F J O'Neil, *chairman;* E D McLeod, J M Gould, K A Howry, T R Smith, J A Woodruff.

New Personnel

H L Young, *chairman;* H C Chapin, L S Little, A E Sampson, P J Wood.

President's Advisory Committee

S L Hayes, *chairman.*

The dues of Senior and Associate members were reported increased to $10.00, by required letter ballot, for the year beginning November 1, 1954. Requested by the Council to draw further amendments to the Bylaws conforming with this change, the Committee on Constitution and Bylaws recommended the following, which were subsequently adopted by letter ballot:

> In Article I, Section 3, change present reading, "A Junior member shall automatically become an Associate member at the age of 28 years, unless he has qualified for Senior membership", to make this read "26 years", effective November 1, 1954.
>
> In Article II, Section 2, increase the dues, for anyone hereafter paying for life membership, from a single payment of $150.00 to $200.00, effective upon adoption of such amendment.
>
> In Article II, Section 4, where a Senior or Associate member elected after May 1st is allowed a credit of $2.50 out of initial dues payment toward dues of the next dues year, increase this credit to $3.00, effective May 1, 1955.

To encourage reinstatement of former members at the increased rate of dues

* Submitted to Am Dyestuff Reptr on May 20, 1954.

the Committee further recommended that penalties for lapses in dues payment prior to November 1, 1954 be cancelled. This also was approved by letter ballot.

Mr Little reporting for the Executive Committee on Research, discussed further work on flammability tests, particularly on fabrics for outer wear. In accordance with established practice the Association was offering its tests and data to those defining the limits for safe use, but was not itself drawing such specifications. Tests for durability of fabrics in dry-cleaning were under consideration. Plans for the research symposium, which was held on May 19th in New York, were discussed.

Despite several resignations, Mr Baxter reported greater receipts from Corporate memberships than for the corresponding period of last year. Albert E Johnson, formerly vice chairman, has succeeded Mr Baxter as chairman of the Corporate Membership Committee.

For the Appropriations Committee Mr Sampson received approval of three minor purchases of fractional shares and permission to make further investments of approximately $10,000.

Chairman Theel of the Publications Committee reported further favorable reviews of "The Application of Vat Dyes", but sales somewhat less than anticipated, because of the specialized character of the book. It was agreed that copies would be sent to secretaries of sections or other officers willing to assume responsibility for them, to facilitate inspection and purchase. James D Dean replaces Professor Phelps on the Committee for the American Dyestuff Reporter Award. Requests for minor revisions in the Dye List of the 1954 *Year Book* have been considered, but it has been decided to postpone all revision of the list, except for correction of errors, until the regular biennial revision of 1955.

Mr Schuler reported that progress on the *Colour Index* seemed to assure publication in 1955. A letter has been mailed to dye manufacturers requesting continued submission of information with view to future supplements. Mr Sampson reported 702 orders received here and abroad, with payments sufficient to cover 22% of the estimated cost of publication.

On motion of Mr Barnard thanks were voted to the Mid-West Section, Mr Camp and his committee for the successful convention of 1953. Mr Gill described plans of the four Southern Sections for the first four-day convention of the Association, September 15 to 18, 1954, in the Atlanta Biltmore. He presented a preliminary budget and was voted a loan of $3,000 from the Convention Fund to cover. The Convention of 1955 is to be in Atlantic City. Progress in organizing the Perkin Centennial celebration of 1956 in New York was described by Mr Jacoby. Papers on topics assigned to various scientific organizations would be assembled in one volume after the convention. Plans of the three New England Sections for November, 1957, in Boston were presented by Mr Kaswell, and were approved with understanding that the dates would be changed to October should space later become available in the Statler.

Mr Young reported the work of the Committee on New Personnel practically completed.

For the Membership Committee Mr Hayes presented applications for membership which were approved as follows:

CORPORATE

Augusta Chemical Co, B F Goodrich Chemical Co, Lowell Technological Institute Research Foundation.

SENIOR

J Alexander, J G Baric, B M Beer, A Berli, A Brizzi, W R Brode, E Brunnschweiler, P Bullock, N J Callahan, L W Carpenter, M C Carpenter, C M Christianson, J A Cooney, J Corbiere, F W Cox, Jr, R Debacker, H C Felsher, A S Fern, J E Flesch, G Flexner, S H Foster, A Foulds, L I Frosgong, E J Garrott, D E Haigh, B H Hallowell, B F Henderson, J K Heywood, A C Holdsworth, Jr, J C Jacobs, J R Janket, K W Johnson, H P Koontz, T Kimura, B H Kirby, X Kowalski, W Kunedt, H P Landerl, F Langford, F M Lotter, F J Lynch, J W Maher, A R Martin, M Millman, M S Mitchell, N S Newman, K Noyori, P D Pence, R M Pines, C J Pospisil, J P Racine, S L Sampson, H U Schmidlin, S Schwartzman, H Sieben, P F Spitzer, Jr, P A Studer, P J Tocco, L H Velez, J H Wakelin, L A Wennerlund, C Wolf, R F York, A H Zayotte, Jr.

JUNIOR

J V Clark, L L Cook, R M Dameron, J E Hall, J J Kelley, Jr, H K T Louis, E A Schlaginhaufen, L S Stern, A R Therrien, C R Williams.

ASSOCIATE

J F Beck, G T Cartier, B M Davis, J C Fenley, B Gammons, H I Hersh, J A Holder, Jr, C A Kratsch, J W Lakin, V E Moore, S B Mulder, J D Smith, J R Stefanacci, W P Williams.

STUDENT

A Anninos, P Bodenhorst, O M Belisle, B H Bell, W A Burton, B R Clement, J J Conlin, H Cook, J D Cox, M S Czekanaki, A A Denio, H Greenberg, M E Gridley, Y Handfield, J E Hester, R B Huey, P Lamprey, F T Libbey, F R McDonald, P B Moring, Jr, C D Moulton, L W Muscelli, J S Murray, C A Nanopoulos, R L Neely, F W Obear, E A Tetzner, S G Thompson, P Turner, J E Ward, R C Welch, J Wright, Jr.

Transferred from other classifications to Senior:

A W Bloxham, W C Carter, R E Crowell, F H Dumproff, R G Ellis, L S Gifford, S T Holland, Jr, T F Innes, J J Kelleher, A A Kuehn, G O Langlais, K G McKenzie, A M McNally, J L Neal, R A Putinier, L L Shailer, W G Silva, R A Strickland, J T Taylor, J F Valente.

Respectfully submitted,
H C CHAPIN, *Secretary*

SECRETARY'S FINANCIAL REPORT—DECEMBER 31, 1953

Received and transmitted to Treasurer	*Applications*	*Dues Regular & Reinstate*	*Dues Corporate & Sustaining*	*Miscellaneous*	*Totals*
August 1 to October 30, 1953	1343.00	21834.00	680.00	13509.46	37366.46
October 30 to December 31	953.50	15925.50	28925.00	4746.06*	50550.06
Total in fiscal year to December 31	2296.50	37759.50	29605.00	18255.52	87916.52
Leaving deposited by Treasurer with Secretary					3450.92
For comparison, receipts to December 30, 1952	2217.00	35142.50	23662.50	6435.75	67457.75

Miscellaneous items,	*
Dividends	400.00
Reporters and reprints	221.70
Year Books	729.13
Crockmeters	651.53
Crock cloth	3.30
Multifiber cloth	4.50
Moth cloth	6.80
Water test apparatus	27.10
Dyed standards	114.00
Knitted tubing	221.20
Gas fading units	1.00
Buttons	4.00
Color transfer charts	180.00
Flammability apparatus	2.00
Colour Index prepayments, Sept	116.00
Analytical Methods	46.00
Application of Vat Dyes	792.00
Standard grease wool	59.25
Acceleroter	94.90
Grey scales	27.00
American Dyestuff Reporter Award fund	1044.65
	4746.06

PHOTOS OF RECENT RHODE ISLAND SECTION MEETINGS

(Courtesy of John E Trezise, Onyx Oil & Chemical Co)

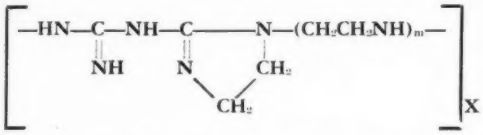
• PATENT DIGEST •

PAUL WENGRAF

IMPROVING FASTNESS OF DIRECT DYEINGS——Condensates of Polyamines with Dicyanodiamide C, 4, 01

U S Pat 2,649,354
(Sandoz Ltd——Hemmi, Trefzer——Aug 18, 1953)

U S Pat 2,622,075 (same assignees) describes the manufacture of water-soluble condensates of polyamines with dicyanodiamide. The resulting products correspond to the general formula:



(wherein "m" is a positive integer and "x" an integer greater than one).

According to the current invention, a further development of the above patent, these products as such or in the form of their copper complexes can be used for improving the fastness properties of direct dyeings or prints. The condensates are syrupy, almost colorless liquids, applied as such or in the form of their salts. Furthermore, they possess the property of precipitating acid dyestuffs from their aqueous solutions.

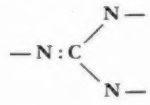
Example: triethylene tetramine is refluxed while being stirred with dicyanodiamide at 100-110° C. After the mass becomes clear it is warmed to 140° C and maintained at this point for 14-16 hours. After cooling and powdering the solidified mass can be used in this form or combined with copper salts for the purpose mentioned above.

Another example (#9): viscose dyed with 2% Solar Violet BL is aftertreated with a solution of 0.3 g per liter of this condensate at 20-100° C for 5-20 minutes. The dyeings reportedly are resistant to washing even in alkaline liquids without intermediate drying. The same effect may be obtained with other dyes of this class, such as Solar Rubinol B, Solar Gray 2BL and Solar Gray R.

Among the references cited by the Patent Office:

U S Pat 2,214,067 (Gen Aniline/1940): improving the fastness of direct dyeings by an aftertreatment with a condensate of an amine (e g, aniline or dodecylamine) or a polyamine, formaldehyde and an ammonium salt.

U S Pat 2,364,725-6 (Ciba/1944): increasing the fastness properties of direct dyeings by an aftertreatment with cationactive high molecular compounds combined with copper compounds or by an aftertreatment of condensates of formaldehyde with bases containing the grouping



U S Pat 2,526,106 (Ciba/1950): improving the fastness of direct dyeings by applying an alkali-soluble copper complex compound combined with dicyanodiamide or guanidine-formaldehyde [cf *Am Dyestuff Reptr 40,* 198 (1951)].

Brit P 522,539 (I G Farben/1940): increasing the fastness of direct dyeings by an aftertreatment with condensates of alkylene diamine-formaldehyde or a polyalkylene polyamine with formaldehyde.

DYEING POLYACRYLONITRILE FIBERS——Cuprous Ion Technique, Using Hydroxylamine C, 4, 07

U S Pat 2,653,074
(Du Pont——Blaker——Sept 22, 1953)

An essential contribution toward the successful dyeing of acrylonitrile fibers is the application of dyeing liquids containing cuprous ions [cf *Chem Eng News 28,* 4268 (1950)]. The dyes are applied from aqueous solutions containing cuprous salts obtained from cupric salts and sodium- or zinc-formaldehyde sulfoxylate. It has been observed that it is practically impossible to prevent precipitation of metallic copper especially when short dyebaths are employed; in larger dyebaths the cuprous ions are prematurely oxidized by air to cupric ions, which are useless for the dyeing effect.

It is claimed that this problem can be solved by transforming the cupric into the cuprous salt when the former is reacted with hydroxylamine either in situ (as reported in most of the examples) or by adding it together with a cuprous salt to the dyebath. It is suggested that the following amounts of the components be employed: 0.25-3.0% by weight of cuprous ion and 0.15-3.2% by weight of hydroxylamine (calculated from the fibers' weight) in a dyebath of pH 1-5 at 190-250° F. The method may be applied to fibers composed of acrylonitrile homopolymers or copolymers with vinyl derivatives, such as Dynel. Direct colors containing acid groups (but employed for dyeing cellulose) and acid colors may be used in this process. Examples of appropriate dyestuffs include Pontacyl Wool Blue BL Conc (C I 833), Pontachrome Yellow 3RN and GS (C I 40 and 36 respectively) or Erio Chrome Violet BA Conc (C I 169).

Example: a dyebath solution is made up of 0.125 p cupric sulfate, 0.04 hydroxylamine sulfate and 1% Pontacyl Fast Red AS Ex Conc (C I 176) in 12.5 p water in order to dye 2.5 p polyacrylonitrile a bright red. The color is exhausted by treating the fabric in a boiling bath for 15 minutes.

Among the references cited by the Patent Office:

U S Pat 2,148,659 (Ciba/1939): increasing the fastness of direct dyes on cotton by dyeing and treating in the same bath with complex-forming metal compounds, especially copper salts, e g, triethanolamine plus cuprisulfate or copper sulfate plus sodium gluconate.

An article by Shirley on page 84 of the October, 1950 issue of *Rayon Synthetic Textiles* mentions certain copper salts which may serve as dye assistants for Dynel.

Reference may further be made to an article on page 531 of *Textile Research J 21* (1951), which discusses the copper-dyeing technique for acrylonitrile fibers. This article suggests the use of Sulfoxite C (sulfoxylate-formaldehyde) as a reducing agent.

Hydroxylamine or salts thereof have been mentioned in an article by Szlosberg in *Am Dyestuff Reptr 41,* P510 (1952), thus after the application date of the present patent (August 2, 1949).

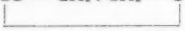
DYEING POLYACRYLONITRILE FIBERS——Lactones or Cyclic Carbonates Used C, 4, 07

U S Pat 2,654,652
(Du Pont——Ray——Oct 6, 1953)

Another method of dyeing acrylonitrile fibers containing at least 85% of the polyacrylonitrile is proposed in the current patent. Dyes suggested for use with this method are predominantly of the *dispersed acetate class,* e g, aminoazobenzene, diamino azobenzene, hydroxy-

amino anthraquinone. Although basic dyes may also be used, their poor light fastness is a drawback.

The inventor advocates dyeing the fibers in the presence of lactones or cyclic carbonates containing 3-5 C atoms in the molecule. Examples for these compounds are propiolactone, γ-butyrolactone, or the alkylene cyclic carbonates, such as ethylene cyclic carbonate . . .



and homologs. These substances are specific solvents for acrylonitrile homopolymers or those copolymers containing a major portion of acrylonitrile; surprisingly, it has been observed that *other compounds* described as *solvents* for acrylonitrile polymers cannot be used in this dyeing process. The latter solvents, which at the same time are good solvents for acetate dyes, are enumerated in U S Pat 2,404,714 (Du Pont——Latham/1946); they are especially represented by formamide derivatives such as dimethylformamide.

Example: a fabric made from polyacrylonitrile yarn is padded in a solution of 5 p γ-butyrolactone, 5 p water and one p of the dye 1-4-5-8-tetra amino anthraquinone with a pick-up of 70% of the solution. The wet fabric is steamed for 5 minutes under atmospheric pressure, scoured for 1.5 hours at 100° C in 0.5% soap solution, rinsed and dried. A deep blue shade, fast to washing and crocking, is attained.

Concentrations of dyestuff are not critical in the padding process. As to the fibers to be used, there is a difference in the treatment of polyacrylohomopolymers or copolymers containing a major portion of acrylonitrile only. Copolymers of acrylonitrile with up to 15% vinyl derivatives (vinyl chloride, vinyl pyridine, etc) or with acrylic acids become increasingly soluble in the aforementioned lactone or cyclic carbonate solvents. Consequently the concentration of the solvent has to be reduced to less than 50% of the padding solution to avoid fabric degradation.

Among the references cited by the Patent Office:

U S Pat 2,431,956 (Du Pont/1947): dyeing acrylonitrile polymers by treating with a naphtholate solution, acidifying and coupling with a diazotized base.

U S Pat 2,512,969 (Du Pont/1950): dyeing acrylonitrile polymers in dyebaths containing 1-5% metacresol and a dispersed acetate dye.

U S Pat 2,524,811 (Interchem Corp/1950) mentions the use of gamma valerolactone in a water-immiscible solvent and a solution of alkanolamine oil sulfonate in dilute sodium phosphate.

U S Pat 2,535,098 (Monsanto/1950) mentions the use of gamma valerolactone and gamma butyrolactone as dyeing assistants for cellulose ethers and esters [cf *Am Dyestuff Reptr 40,* 350 (1951)].

U S Pat 2,543,316 (Carbide & Carbon/1951): dyeing acrylonitrile-vinyl copolymers under pressure at elevated temperatures to increase the dye affinity [cf *Am Dyestuff Reptr 40,* 375 (1951)].

Brit P 599,055 (Brit Celanese/1948): dyeing cellulose esters or ethers from a mixture of diluted lower alcohols and inorganic thiocyanates, and steaming.

ABSTRACTS

For the convenience of our readers, we list the addresses of the publications from which the following articles are abstracted:

Textile Research Journal, 10 E 40th St, New York, N Y
Du Pont Dyer & Finisher News, Wilmington 99, Del
Journal of the Society of Dyers & Colourists, 32-34 Picadilly, Bradford, England
The Dyer, Drury House, Russell St, Drury Lane, London WC2, England

Preparation of Soluble Yarns by the Carboxymethylation of Cotton

G C Daul, R M Reinhardt, and J D Reid, *Textile Research J* 23, 719-26, October, 1953.

Details are given of the preparation of soluble fibers from cotton cellulose by carboxymethylation. Water- and alkali-soluble fibers, yarns, and threads have been prepared by two methods. The cotton is preferably pretreated by pressure-kiering in 2 percent sodium hydroxide to remove the noncellulosic materials, and then treated with monochloracetic acid and sodium hydroxide by either a one-step or a two-step process. Where only disintegration or partial solubility is required, the one-step method is sufficient. Where complete solubility of the cotton is required, the process must be carried out in two steps: a mild, followed by a stronger treatment. The treated cotton is neutralized in alcohol with acetic acid to produce water-soluble products, or with strong acids in alcohol to produce water-insoluble but alkali-soluble products.

The authors explain that when strong acids, such as hydrochloric and sulfuric, are used in the neutralization process, the free acid of carboxymethylcellulose, which is insoluble in water but soluble in dilute alkaline solutions, is formed. Acetic acid, however, does not remove the sodium ion from the sodium carboxymethylcellulose, which is soluble in water.

Cotton in the form of sliver, yarn, and thread has been successfully treated by this method, according to the authors. They state that soluble cotton in the form of sliver tends to be harsh and has high friction characteristics. These defects can be overcome by treatment with lubricants or softening agents in solutions of acetone or alcohol. Lubricated soluble cotton sliver was spun into yarn on a small scale without difficulty, and a mixed cloth was woven with plain and treated yarn.

It is claimed that the soluble cotton products have several advantages over the alkali-soluble alginate fibers. They may be produced either in the free acid form, which is alkali-soluble, or in the form of the sodium or ammonium salts, which are soluble in ordinary tap water. Any of these forms would have considerably more tensile strength than that attributed to the alginate.

Lace and embroidery makers, shirt manufacturers, upholsterers, fur blenders, and meat packers have shown interest in the soluble cotton products.—WHC

Fundamentals of the Dyeing of Cellulosic Fibers

H R McCleary, *Textile Research J* 23, 673-82, October, 1953.

The annual production of coal-tar dyes in the U S amounts to approximately 150,000,000 lbs, of which about 60 percent is used for cellulosic fibers. The two dye types making up most of this 60 percent are the direct dyes and the vat dyes.

The large majority of direct dyes are organic azo sulfonic acid salts which are water-soluble and which have marked affinity for cellulose. This property of a dye to be preferentially adsorbed is called "substantivity." It is obvious that substantivity is a unique property of dyes, since many colored compounds have no substantivity.

The vat dyes are water-insoluble compounds based historically on indigo, although a great many dyes in this class are derivatives of anthraquinone and related compounds. The common feature of all vat dyes is that they contain carbonyl groups which may be reduced in alkaline solution yielding the soluble alkali salts of corresponding hydroxyl derivatives—the leuco compounds. When cellulosic materials are immersed in these

"sodium leuco" solutions, the leuco dye, as an anion, is absorbed in much the same manner as the direct dyes, and is therefore "substantive." Oxidation of the leuco in cellulose gives back the insoluble pigment form of the vat dye, which is "trapped" within the cellulose structure, and which is therefore very fast to washing.

The mechanisms by which dyes transfer from solution to fiber, the factors which control the rate and equilibrium value in dyeing, and the reasons for substantivity are discussed by the author. The theoretical aspects of the dyeing of cellulose with substantive dyes are reviewed.

It is pointed out that the oriented chainlike structure of cellulose, containing both amorphous and crystalline regions, influences both its dyeing properties and the optical appearance of dyed fibers. Dye sorption is believed to occur only in the amorphous regions, where single molecules of dye are coordinatively bound to cellulose chains.

Dyeing appears to be a diffusion-controlled reaction which determines the rate of dye bath exhaustion. The movement of dye through a fiber is a hindered diffusion process further modified by sorption of dye. Filament size has an effect on the appearance of dyed fibers because of differences in the light which is scattered. The skin structure of rayons slows down the penetration of dye to the interior of the fibers.

References are made to 27 journal articles.—WHC

New Du Pont Vat Print Development Process

Anon, *Du Pont Dyer and Finisher News* #2, 1953, p 1-2.

A new process has been developed by Du Pont for printing vat dyes on cotton, rayon, nylon and certain other fibers which is proving far superior to conventional printing methods, it is claimed. The new technique is similar in principle to the popular pad-steam continuous dyeing process, the main variation being in the method of applying the caustic and hydrosulfite. The vat printing development process uses an allover engraved roll for applying hydrosulfite and caustic soda to prints made with neutral thickeners on customary screen or roller equipment. In conventional processes only selected "printing types' of vat dyes give satisfactory results, while the same dyes applied by the new technique show 10 to 15 percent increase in color value, it is claimed. With the new process it is stated that the complete range of anthraquinone and indigoid vat dyes can be printed advantageously, the results showing greater brightness of all types and a significant improvement in fastness to crocking and washing. Printing costs are said to be reduced 25-30 percent.

Prints made with vat colors on conventional screen or roller equipment from neutral thickeners can be stored indefinitely, since there is no reducing agent present to cause color decomposition. At a later date, or even after drying, the material is led face down through a single color printing machine or a padder containing an allover engraved roll, where the thickened caustic soda and hydrosulfite are applied to the previously printed fabric face. The engraved roll is furnished in the usual manner and is fitted with the usual doctor blades. The material immediately enters an air-free steamer of special design, where it is steamed for approximately 15 seconds at 214-216° F. The cloth coming from the delivery end of the steamer is immersed in the first box of an open soaper, where the goods are rinsed with cold water, oxidized, and soaped.

The best dye thickener for general use consists of a mixture of one part of 4% sodium alginate and three parts of 10% wheat starch.

Conventional rapid agers or other steamers commonly used in printing are not satisfactory for aging the impregnated fabrics.

Numerous mill trials have been made with the new print development process and have confirmed laboratory indications. Under proper operating conditions there was no flushing of the printed pattern, and the unprinted areas were not stained or otherwise adversely affected during development.—WHC

The Application of Identification Tints, with Particular Reference to Acetate Rayon Staple

H C Olpin and A J Wesson, *J Soc Dyers Colourists* 69, 357-62, October, 1953.

The materials usually available for tinting may be considered in three sections, viz, pigments, oil-soluble dyes, and water-soluble dyes, the latter being by far the most important.

Pigments have been used in the past, but they are all subject to one disadvantage, namely that they are in the nature of "soils", and it is extremely difficult to remove all "soil" from textile materials.

Oil-soluble dyes dissolved in the spinning oils used in textile processing have met with only limited success, and would be valueless on acetate because of their staining propensities.

Of the water-soluble dyes, basic dyes have affinity for both wool and acetate, and are therefore unsuitable for tints. The acid dyes usually have good affinity for wool but none for either acetate or viscose staple. Selected members have been used for tinting both the latter fibers. However, they may become fixed on the acetate while it is in a moist, swollen condition, and will then resist scouring. Direct cotton dyes are seldom used for tints because of their affinity for viscose and the propensity to stain wool. At first sight they would not appear to be very promising for tinting acetate destined for blending with either of these fibers, but recent work has led the writers to modify this view.

Polyvinylpyrrolidone, sold under the trade name Albigen A, is described as possessing pronounced dye-binding properties for leuco vat, sulfur, and direct cotton dyes. In the proportion of 4-6:1 on the weight of dye, Albigen A substantially inhibits dyeing of a number of direct cotton dyes on cellulose, the extent varying with the individual dye. Chlorazol Fast Pink BKS and Solophenyl Blue Green BL are among the dyes most affected in this respect, and were selected for further investigation as tints.

Acetate staple was sprayed at the hopper with a solution of 2% dye and 8% Albigen A. The tinted fiber was mixed with viscose staple and with wool. The mixed fibers, after spinning and knitting, were subjected to various wetting, conditioning, and steaming treatments, and were then scoured to remove the tint. In all cases the tints were completely removed, indicating no fixation of dye on any of the fibers.—WHC

The Dyeing of Viscose Rayon at High Temperatures

K Butterworth, *J Soc Dyers Colourists* 69, 362-9, October, 1953.

In recent years the attention of various machinery manufacturers has been directed towards the production of machines suitable for dyeing packages above 100° C, and numerous machines are available. These methods are becoming of increasing importance.

The author gives the results of experiments showing the effect of dyeing at temperatures varying from 85° to 130° C on direct and vat dyes, on the viscose fiber itself, and on the levelness and fastness of the resultant dyeings.

Direct Dyes. These fall into three classes, 1) those dyes which are stable when dyed at high temperatures under neutral conditions and which also show considerable resistance to decomposition under alkaline conditions; 2) those dyes which, although not unduly affected when dyed at high temperatures in the absence of alkali, are completely destroyed in alkaline solutions; and 3) dyes which are decomposed under both neutral and alkaline conditions. A large number of dyes (with British names) are listed by the authors under these three classes.

The decomposition due to alkaline re-

duction in class (2) may be avoided by means of either pH control or the judicious addition of oxidizing agents. However, direct dyes are not generally very resistant to oxidizing agents, and there is always a danger that excessive additions of these compounds will have an adverse effect on the shade.

The use of high-temperature techniques is likely to be of most value in package dyeing, particularly for dyeing viscose rayon cakes. The problems associated with this system of dyeing are due in the main to the difficulty of redistributing the dye which is initially absorbed on the more accessible portions of the cake. It is found that the redistribution of direct dyes is improved to a considerable extent at elevated temperatures, particularly if the use of high temperatures is accompanied by salt control.

Trials with four typical direct dyes on viscose rayon cakes at 90° and 120° C indicated that high-temperature dyeing permits equal or better levelling to be obtained in much shorter times than are normally employed.

Vat Dyes. A number of experiments have been carried out on viscose rayon cakes, and the much improved levelling obtained at 120° C has been demonstrated. The higher temperature alone, however, is not sufficient to yield a perfect result, and the use of a levelling agent such as Dispersol VL is still necessary. While these results are of considerable interest, it is doubtful whether a wide range of stable vat dyes will be found from available products.

Effects on the Viscose Fiber. It is generally considered that the viscose rayon itself is adversely affected when treated above 80° C in caustic soda solutions of dyebath strength. The results obtained by the author indicate that yarn dyed up to 120° C with direct dyes should suffer no serious loss in strength. With vat dyes dyed by the alkaline leuco process, however, the yarn may lose 10-20 percent in dry and wet tensile strength.

Twenty references to the literature are cited.—WHC

Thiourea Dioxide in Textile Printing

P Krug and D Horrocks, *Dyer* 110, 475-7, October 2, 1953.

Thiourea dioxide is produced by the oxidation of thiourea with hydrogen peroxide. Judged by the method of its production, it should clearly have the properties of a peroxide, and least of all should it be expected to be a reducing agent. These properties can be explained by the theory that it exists in two tautomeric forms, one of them stable and the other exceedingly unstable. The unstable form is the form which acts as a reducing agent. As a solid it has neither oxidizing nor reducing properties, is practically inert to most of the chemical reagents, and is insoluble in nonpolar solvents. With alkalis in the cold, and on heating in aqueous solution, rearrangement in the molecule takes place, giving a product which has reducing properties. The structure of the new compound is probably that of a sulfinic acid. A complete decomposition takes place, and one of the by-products is sulfoxylic acid, which acts as the reducing agent.

When a printing paste containing a vat color, thiourea dioxide, and a suitable thickening agent is printed on to a textile material and subjected, after drying, to a steaming with saturated steam at 100-102° C, in most cases a reduction to the free leuco vat acid takes place in good yield. Many of the vat acids have affinity for cellulose acetate, wool, and real silk, and it thus becomes possible to achieve fixation of vat colors on these fibers in excellent yields and under acidic conditions with no saponification and very little damage to the fibers.

For the printing of cellulose acetate, a vat dye, thiourea dioxide, and thickener are applied in conjunction with a suitable swelling agent in order to ensure good color yield, penetration, and fastness to rubbing. A combination of polyethylene glycol and urea for screen printing, and polyethylene glycol and thiodiglycol for roller printing has been found especially suitable.

After drying, the prints are steamed at 100-102° C in the normal type of equipment. They are very well rinsed in cold water and oxidized with sodium nitrite and sulfuric acid in a manner analagous to the Indigosols.

The main features of the method can now be summarized: Safe production of vat color prints on cellulose acetate with excellent brightness of shade, without saponification of the cloth, and with no danger of discoloration of whites and no marking off.

The production of discharge prints on cellulose acetate cloth has presented the printer with considerable difficulties. Alkaline discharge agents not only cause saponification of the cloth and impair the hand but give rise to haloing and flushing, and mottled prints in the case of vat colored discharges. The necessary acidic conditions for the discharge printing of acetate are believed by the authors to have found a satisfactory solution in the use of thiourea dioxide. White or colored discharges can now be obtained with safety, they say, even on dark shades, in screen and roller printing.

A number of free leuco vat acids have affinity for wool and real silk. Here the new method offers a convenient way for the application of vat dyes to these fibers in both plain and discharge printing.—WHC

GENERAL CALENDAR

AMERICAN CHEMICAL SOCIETY
National Chemical Exposition—Oct 12-15, Chicago, Ill.

AMERICAN SOCIETY FOR QUALITY CONTROL
Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual Meeting—June 13-18, Sherman and Morrison Hotels, Chicago, Ill.

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS
Quebec Section—June 19 (Annual Golf Tournament).

CHAMBRE SYNDICALE TRAMAGRAS
International Detergent Congress—Aug 30-Sept 5, The Sorbonne, Paris, France.

DELTA KAPPA PHI FRATERNITY
1955 Annual Convention—April 29-30, Lowell, Mass.

DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN
Achema XI—May 14-22, 1955, Frankfurt am Main, Germany.

DRYSALTERS CLUB OF NEW ENGLAND
June 25 (Annual Outing, Wachusett Country Club, West Boylston, Mass).

THE FIBER SOCIETY
Fall Meeting—Sept 13-14, McGill University, Montreal, Canada.

GORDAN RESEARCH CONFERENCES, AAAS
July 12-16, Colby Jr College, New London, N H.

INTERNATIONAL CONGRESS OF INDUSTRIAL CHEMISTRY
27th Congress—Sept 11-19, Brussels, Belgium.

INTERNATIONAL TEXTILE EXHIBITION
2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE
September, 1955—Sydney, Melbourne, and Geelong, Australia.

NATIONAL INSTITUTE OF DRYCLEANING
4th Educational Conference, Dec 5-10, Silver Spring, Md.

PHILADELPHIA TEXTILE INSTITUTE ALUMNI ASSOCIATION
53rd Annual Reunion, June 11, Manufacturers Golf & Country Club, Oreland, Pa.

SOUTHERN TEXTILE EXPOSITION
October 4-9 (Textile Hall, Greenville, S C).

TEXTILE TECHNICAL FEDERATION OF CANADA
4th Seminar—Sept 9-11, Queen's Univ, Kingston, Ont.

NEWS

• Mathieson-Olin Merger Proposed

The boards of directors of Mathieson Chemical Corporation and Olin Industries, Inc, voted unanimously on May 10th to submit to their stockholders at special meetings on June 29 a proposal to merge the two companies.

The name of the new company will be Olin Mathieson Chemical Corporation. Following the merger John M Olin will become chairman of the board of Olin Mathieson and Thomas S Nichols will become president. John W Hanes will become chairman of the finance committee.

Based on 1953 figures, the combined corporation will have total assets of about $500,000,000 and sales of over $500,000,000, including sales of nonconsolidated subsidiaries and licensees.

The proposed combination will be one of America's important diversified processing and manufacturing enterprises. Both companies were founded in 1892, generally are of the same size and each has approximately 18,000 employees.

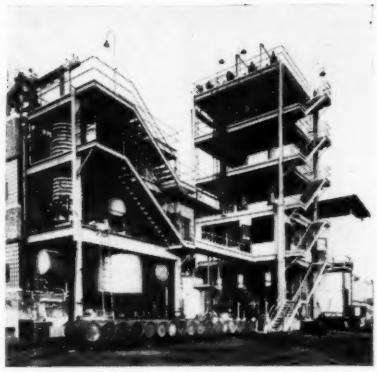
Mathieson's operations are world wide and include 25 plants in the United States and 16 in foreign countries. Olin operates 18 plants, all in the United States.

• Althouse Offers New Trade Service

Althouse Chemical Company, Reading, Pa, has arranged to obtain the colorfast seal of the American Institute of Laundering free of charge for cotton and rayon finishers using the Company's Superlite-fast dyes, provided the fabrics pass AIL tests.

• Carbide Announces New Price Reductions

Price reductions of 5 cents per pound for Carbowax methoxy polyethylene glycols 350, 550, 750, and 1250 were recently announced by Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. Current price schedules are as follows: tank car lots, 29 cents per pound; carload lots in drums, 30½ cents per pound; less carload lots in drums, 31 cents per pound. Prices quoted are f o b South Charleston, West Virginia.



This rear view of the high pressure acetylene plant of General Aniline & Film Corporation at Linden, N J, is the type of some of the installations to be erected by the company at Calvert City, Ky.

• GAF to Construct Acetylene Plant in Kentucky

The General Aniline & Film Corporation has announced plans for the building of a $6,000,000 plant in Calvert City, Ky, for the commercial manufacture of products of high-pressure-acetylene chemistry, i e, acetylene derivatives. The new facilities are expected to be in operation by the end of 1955 and will incorporate many features of the Company's pilot plant at Linden, N J, which opened in 1949.

Since the opening of the Linden plant, more than 30 new products have been manufactured there in semicommercial quantities. The Linden plant today is the only manufacturing installation for the production of high pressure acetylene derivatives in the Western Hemisphere and will continue to carry out pilot plant work and semiworks production.

The Lummus Company of New York, N Y has been retained for engineering and construction.

Civil Service Openings for Chemists

The Board of U S Civil Service Examiners, Army Chemical Center, Maryland, has announced openings for chemists (GS-9 thru GS-15), paying $5060 to $10,800 per year. Places of employment are in Pennsylvania, Delaware, Maryland and Virginia. For further information, write to the Board for announcement 3-112-2 (1954).

• Further Stowe-Woodward Expansion

Stowe-Woodward, Inc announces that a second branch plant at Neenah, Wis will bring Stowe-Woodward service close to Mid-West textile finishers. The announcement follows the earlier disclosure that the Massachusetts firm had purchased 16 acres of land in Griffin, Ga for the erection of a rubber roll plant similar to the "home" installation at Upper Newton Falls.

Stowe-Woodward has concluded lease agreements with the J W Hewitt Machine Co providing manufacturing, laboratory and office space for rubber roll production at Neenah.

• Atlas Powder Forms German Emulsifier Affiliate

A new German emulsifier company, Atlas-Goldschmidt, GmbH, has been formed jointly by Atlas Powder Company and Th Goldschmidt, A-G, of Essen.

Beginning July 1, the new enterprise will undertake a broad program of product research and development, and will market surface-active agents and emulsifiers throughout Europe and other parts of the world.

Groundwork for the joint affiliate, whose headquarters will be in Essen, was laid by James R Frorer, vice president in charge of Atlas' international operations. Appointed managers of the new organization are Hans Dohse and Heinz B Tillman.

• Price Reductions on Pluronics

Wyandotte Chemicals Corporation, Wyandotte, Mich, has announced an immediate price reduction in the price of all Pluronics, their nonionic surface-active agent. The reduction is approximately $.05 per pound in carload quantities and $.035 per pound in less than carload quantities.

• HTR 28th Anniversary

May 1st marked the 28th anniversary of Hatch Textile Research, Inc, New York testing laboratory founded by Herbert H Hatch, president.

Those associated with Mr Hatch are John W Sheppard, vice president, and Adolph Marklin, senior technologist.

• Fair Lawn Executive Advises Heat-setting for Good Stability in Rayon-Dynel Blends

The successful finishing of rayon-Dynel and rayon-Dynel-acetate blends, while similar to that of standard rayon-acetate fabrics, generally includes a heat-setting operation to obtain the highest degree of fabric stability, according to Weldon G Helmus, president of Fair Lawn Finishing Co, Fair Lawn, N J.

Fair Lawn reportedly has used this technique over the past two years, during which they have finished over a quarter of a million yards of these fabrics, making them one of the largest processors of rayon-Dynel blends in the country.

The finishing of 25-35% Dynel blend fabrics containing rayon and/or acetate generally follows the practices established for the cellulose-base fibers, Mr Helmus pointed out. It is important to note that no unusual drying or curing temperature changes are necessary, he continued, because the use of the higher temperatures is a necessary procedure to stabilize the Dynel in the blend. He advises that this can be achieved during either a resin-curing or semidecating step.

A relaxing scour after resin curing is desirable, but the steaming or semidecating is often substituted because of its double value in stabilizing the colors on the rayon and acetate to the heat of pleating, and in heat-stabilizing the Dynel fiber.

As a result of Fair Lawn's experience with the Dynel blends, Mr Helmus noted that Dynel-content goods are being delivered under the same contracts and to the same high quality standards as rayon and rayon-acetate goods.

On many pastels, it is only necessary to dye the rayon, Mr Helmus stated. Frequently, only the rayon and acetate are colored in darker fabrics, while the Dynel is reserved to give a frosty effect. This dyeing is exactly the same procedure as used for rayon acetate goods, and finishing generally includes resin application, curing, and semidecating — all standard processes.

In finishing, during either resin curing or semidecating, the Dynel-blend fabrics are allowed to relax completely under heat and no tension, to their natural length and width.

When the goods must be hot-stretched, they should be of an original width for them to come in about half the amount they are stretched. Fabrics heat-relaxed in this manner are extremely stable and have safe ironing temperatures, at least as high as those of the regular rayon-acetate goods, Mr Helmus said.

(L to r): Richard G Dexheimer, executive vice president, Onyx Oil & Chemical Co, cuts ribbon dedicating memorial classroom at PTI. Assisting are Leon P Brick, Bertrand W Hayward, Richard S Cox, and Rinaldo A Lukens.

• PTI Honors Late Onyx President

A classroom named in honor of Victor H Berman, the late president of the Onyx Oil & Chemical Company, Jersey City, N J, was dedicated at the Philadelphia Textile Institute, Germantown, Pa, on Thursday, May 13th.

Onyx officials at the ceremony were Richard G Dexheimer, executive vice president, and son-in-law of the late Mr Berman, Albert R Jenny, vice president and Leon P Brick, vice president and PTI alumnus, class of 1925.

PTI officials Bertrand W Hayward, director, Rinaldo A Lukens, president, and Richard S Cox, dean emeritus, participated in the ceremony.

Mr Cox, treasurer of The Philadelphia Textile Institute Foundation noted that Onyx Oil & Chemical Company had contributed $14,000.00 to its fund campaigns.

• ΔΚΦ Convention

The 30th Annual Convention of Delta Kappa Phi Fraternity of America, Inc was held at Raleigh, N C, April 2-3, with Kappa Chapter (North Carolina State College School of Textiles) as hosts.

Rep Cooley (D-NC), served as the main speaker at the Saturday evening banquet, which was attended by approximately 150 members from all parts of the country.

The following slate of officers were elected to serve for another year: Supreme Consul—A Ward France, Supreme Pro-Consul—Henry A Rutherford, Supreme Annotator—Clifford M Gilpin, and Supreme Custodian—Stanley Pikalow, Jr.

The 1955 Convention will be held April 29-30 at Lowell, Mass.

Note

Your attention is called to a reversal of captions under the photos of C D LaSusa and R S Haley on page 253 of the April 12th issue.

• 300 Attend Annual Meeting of Quebec Section, CATCC

L J Sheps, Trilon Chemicals Ltd, Montreal, was elected president of the Quebec Section, Canadian Association of Textile Colourists and Chemists during the recent annual meeting of the Section at the Sheraton-Mount Royal Hotel in Montreal. About 300 delegates attended the business meetings on April 23rd and the annual banquet on the 24th.

A feature of the Friday session was the forum on quality control with T H Hilliard, Canadian Celanese Ltd, Ralph B Hood, Duplan of Canada Ltd and Francois E Clevn, Textile Sales Ltd, as speakers.

In addition to Mr Sheps, the following officers were elected: Ernest Bradley, honorary president; L E Moody, Duplan Dyeing Co and C E Coke, Courtaulds (Canada) Ltd, vice presidents; J H Lowe, Nova Chemical Corp, secretary; and A Greyborn, Bruck Mills Ltd, treasurer. Council members elected were: James Fallows, Halifax Corduroy Ltd; John Hollis, Angora Mills Ltd; J J Soroka, Fabric Dyers Ltd; S H Chambers, Montreal Cottons Ltd; G S Wilkie, Geigy Chemical Co Ltd; and John Dean, Canadian Celanese.

Leon Moody, chairman of the exhibition committee, was in charge of an exhibit held in conjunction with the meeting. On display were 3000 different fabrics and some garments produced by 32 Canadian textile mills.

• Triton X-100 Price Reduction

Reduced prices of one of its most widely used surface active agents, Triton X-100, have been announced by Rohm & Haas Company. Reductions, which take effect immediately, are as follows: tank truck and tank car lots, from 31½ cents to 28¾ cents per pound; truckload and carload lots in drums, from 33½ cents to 30½ cents; less than carload in drums, from 36 cents to 32 cents. Corresponding reductions in the prices of three other surface active agents manufactured by the company, Triton X-102, Triton X-114, and Triton X-138, became effective at the same time.

• Foxboro to Build New Factory in California

Ground has been broken for a new branch factory to be erected at 399 Preda Street, San Leandro, California, by The Foxboro Company, Foxboro, Mass, manufacturer of industrial instruments for process measurement and control. Scheduled for completion by August 15, the new 8400-square foot building will more than double the production area of the present San Francisco shop.

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